AD-A138 248 RECREATIONAL REUSE OF WASTE DISPOSAL SITES: CHANUTE AIR FORCE BASE ILLINO..(U) CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY) CHAMPAIGN IL T G HARKNESS ET AL. 1/2

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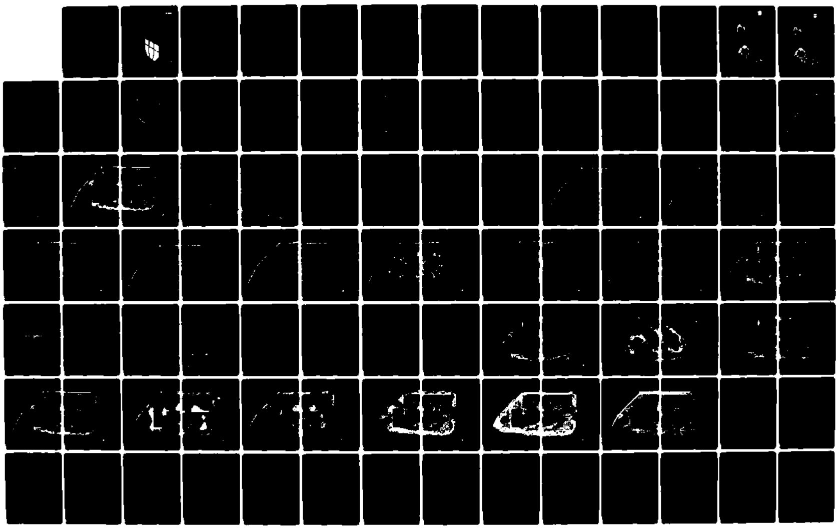

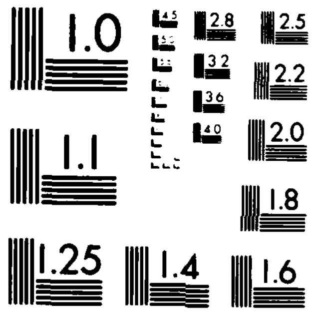


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US Army Corps
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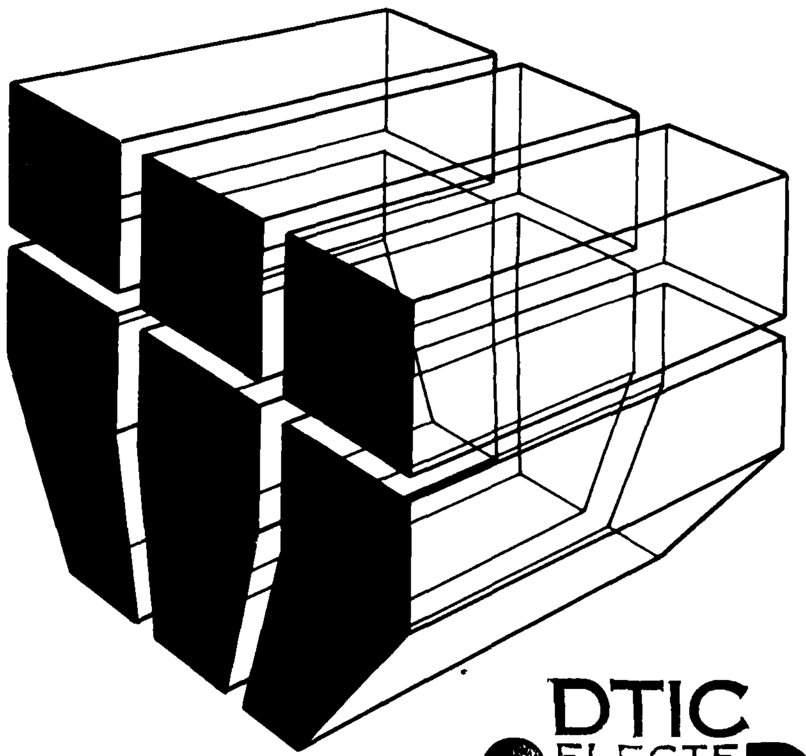
TECHNICAL REPORT N-165
November 1983



# RECREATIONAL REUSE OF WASTE DISPOSAL SITES: CHANUTE AIR FORCE BASE, ILLINOIS



by
Terence G. Harkness
Lawrence J. Schmitt
Robert E. Riggins

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| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|---|---|---|
| 1. REPORT NUMBER<br>CERL TECHNICAL REPORT N-165 | 2. GOVT ACCESSION NO.<br>AD-A138 248 | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle)<br>RECREATIONAL REUSE OF WASTE DISPOSAL SITES: CHANUTE AIR FORCE BASE, ILLINOIS | | 5. TYPE OF REPORT & PERIOD COVERED<br>FINAL |
| | | 6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s)<br>Terence G. Harkness<br>Lawrence J. Schmitt<br>Robert E. Riggins | | 8. CONTRACT OR GRANT NUMBER(s)<br>DACW 88-82-M-0873<br>DE-82-231 |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>U.S. Army Construction Engr Research Laboratory<br>P.O. Box 4005<br>Champaign, IL 61820 | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 11. CONTROLLING OFFICE NAME AND ADDRESS | | 12. REPORT DATE<br>November 1983 |
| | | 13. NUMBER OF PAGES<br>98 |
| 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) | | 15. SECURITY CLASS. (of this report)<br>UNCLASSIFIED |
| | | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from the National Technical Information Service
Springfield, VA 22161

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Chanute Air Force Base, Illinois
recreation
lakes
feasibility studies

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This study was designed to determine the feasibility of and develop plans for a recreational facility on an abandoned waste disposal site at Chanute Air Force Base in Rantoul, Illinois. The facility will consist of a 20-acre fishing lake with associated picnic and campgrounds on a 100-acre site at the base. Construction of this facility will result in the reclamation of two sewage lagoons and several landfills.

(over)

Results from this investigation indicate that the project is feasible. Reclamation and construction recommendations are described. Landscaping recommendations are made for innovative, low-maintenance planting over a 10-year period. A plan for developing and maintaining a sport fishery is described.

## FOREWORD

This study was performed for the Civil Engineering Division of Chanute Air Force Base in Rantoul, Illinois, under contract No. DE-82-231 (Military Interdepartmental Purchase Request). Mr. Ralph Mitchell was Project Coordinator at Chanute. This investigation was conducted by the Environmental Strategy Development Team, Environmental Division (EN) of the U.S. Army Construction Engineering Research Laboratory (CERL). Dr. R. K. Jain is Chief of CERL-EN, and COL Donald A. Heinz is Base Civil Engineer at Chanute.

Daily and Associates Engineers of Champaign, Illinois, performed a feasibility study as part of this project (Contract No. DACW 88-82-M-0873).

COL Paul J. Theuer is Commander and Director of CERL, and Major General Joseph Moore is Center Commander of Chanute AFB. Dr. L. R. Shaffer is Technical Director of CERL.

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# 1 INTRODUCTION

## Background

Chanute Air Force Base, Illinois, is developing a 100-acre recreational area to include noncontact, water-based recreation, picnicking, camping, and other activities. This project is unique for several reasons. First, the site contains one closed landfill and is adjacent to several others. In addition, the lake will incorporate two existing sewage lagoons. These unique features have demanded an unusual approach to project design. This proposed site has generated concern for lake development feasibility, i.e., the area's ability to support a lake and assure adequate long-term water quality.

The project will be time-phased over several years and reserve Army engineer units will do most of the construction during summer training periods. Recreational design will provide innovative low-maintenance planting strategies in which landscaping will become established over a number of years.

## Objective

The objective of this work was to determine project feasibility and to develop design concepts that accommodate the required method of construction and incorporate a low-maintenance planting strategy.

## Approach

The project's feasibility was determined primarily through water quality assessment and soil analyses performed by Daily and Associates Engineers. Once the site appeared viable for the project, CERL developed concepts for lake construction and low-maintenance landscaping with long-range schedules for each. A program for lake management was also devised for developing and maintaining a quality fishery.

## 2 CONCEPT DESIGN

Recreation has become an important aspect of providing a well balanced training and living environment at Air Force facilities. The Morale, Welfare, and Recreation (MWR) branch has developed many programs to provide recreation for trainees. As part of an effort to meet this goal, Chanute AFB leases a recreational facility west of Paxton, IL. This 150-acre site provides picnicking, camping, and fishing, and is available to Air Force personnel for day and overnight use. It is an attractive, wooded area; however, two drawbacks to current use of this facility are: (1) the uncertainty that it will be available in the long term, and (2) the distance and inaccessibility for trainees from Chanute. These circumstances are disadvantageous to the base's overall recreation program. A large, pleasant facility within easy reach of trainees but removed from the temporary and permanent housing areas would be more desirable. This would be a special recreation area visually distinct from the day-to-day training environment of residence halls and classrooms.

In addition to the Paxton Recreation Facility (leased property), MWR provides an overnight campground on base for Air Force personnel using their own equipment or MWR rentals. This facility also is open to military personnel vacationing in the area. The campground is available at a modest rental fee; however, at present it has few recreational amenities other than pads and utilities.

This design proposal will combine Chanute's fishing, camping, and recreational opportunities through the redevelopment of two abandoned sewage treatment lagoons. The lagoons will become the focus for a major 100-acre recreational park and lake (Figure 1). This area will provide day and overnight use for trainees, permanent residents and their families, and traveling military personnel.

Development of this facility will be a major opportunity for the base's recreation program. The lake project is the initial step in long-range plans for base recreation magnets -- centers that accommodate base-wide activities (Figure 2).

The <u>Recreation Lake</u> will be the focus for environmental or outdoor activities such as fishing, camping, picnicking, and nature study.

Three other centers of the recreation magnet concept will be:

1. The <u>Aircraft Park and Visitor Center</u> with adjacent playfields, jogging track, picnic area, and new gymnasium. This facility will serve trainees, visitors, and permanent base residents.

2. The existing <u>Community Center</u> with theater, food service, library, mall, retail, auto repair, craft shops, and bowling lanes used by all base personnel.

3. The new <u>Youth Center</u> with adventure playground, swimming pool, golf course and clubhouse.

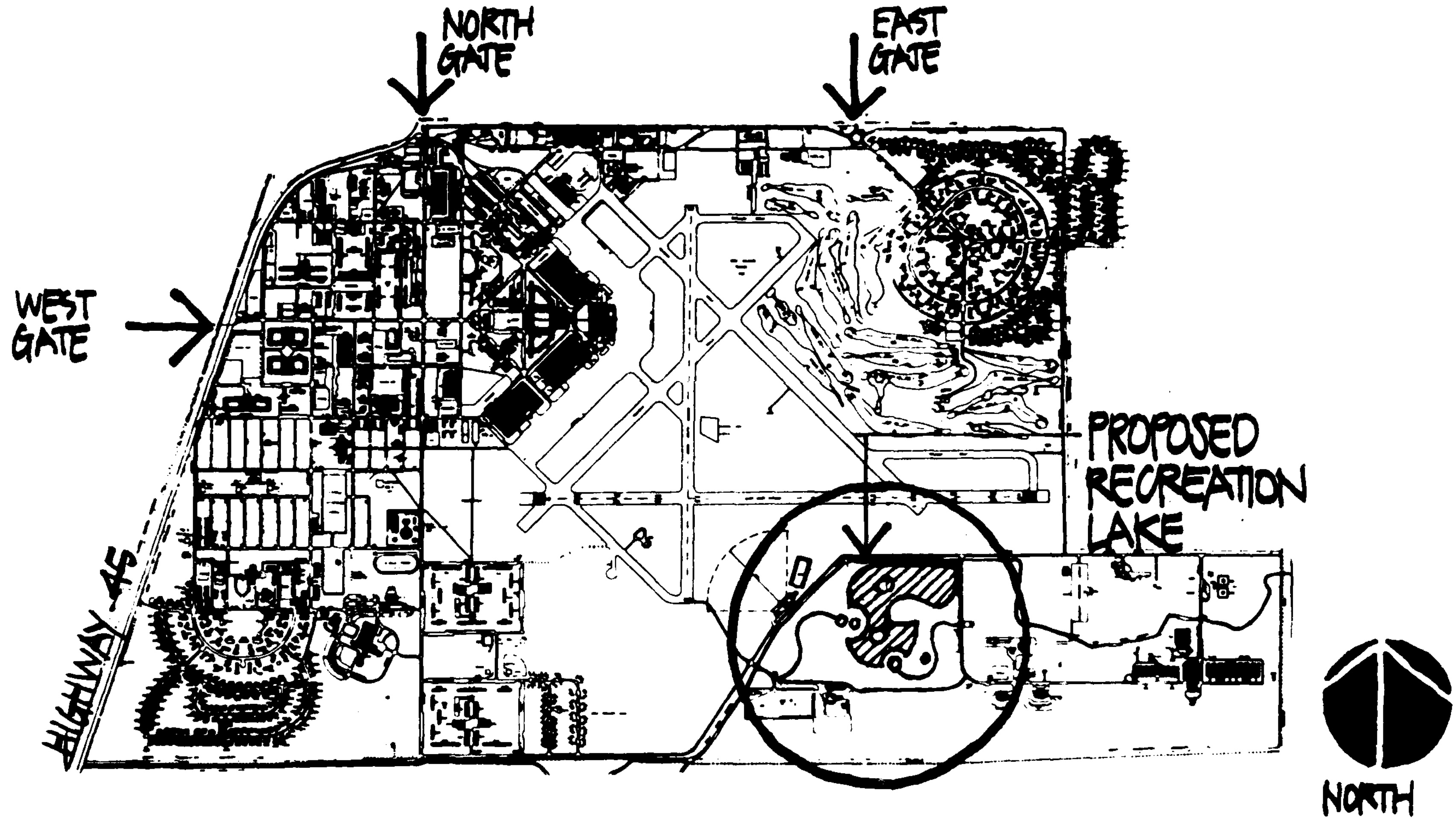


Figure 1. Layout of Chanute Air Force Base, including the proposed recreation area.

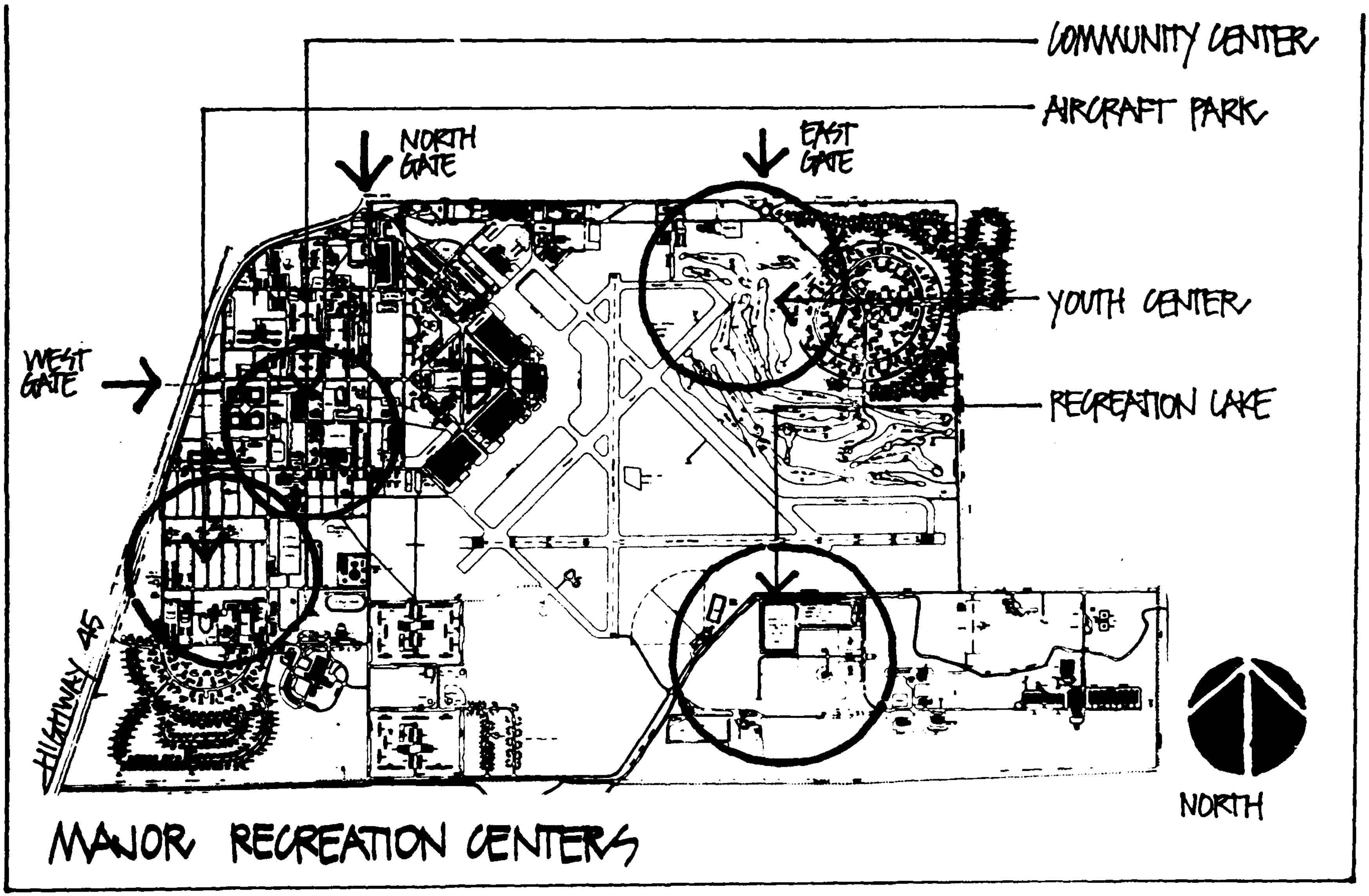


Figure 2. Major recreation centers.

These four areas will become the focus for future outgrowth of additional recreation programs and facilities. The design concept outlined above is supported by a very important implementation strategy for creating the new lake and park. This strategy will be based on two important objectives: self-help and training/education.

Base personnel will build part of the recreation lake while on equipment training duty. In addition, other military branches will have an opportunity to take part in real training situations central to their military mission when they assist with the project. Branches that might be interested are: U.S. Army engineer units, special Air Force groups such as Prime Beef and Red Horse units, and other construction units.

Opportunities for training and construction will include horizontal work, demolition, paving, grading, excavation, road base placement, utility relocation, and rock crushing during the first year. During the second year, vertical work will begin, i.e., facility construction, playfield layout, utility hookup, and tree-planting (see Chapter 5).

The second objective of the implementation strategy will involve self-help, i.e., base personnel and volunteer groups donating time, money, and labor. These resources are readily available and will go far toward incorporating the new facility into life at the base.

## 3 PROJECT FEASIBILITY INVESTIGATION

### Site Description

The site is on the south end of the base as shown in Figure 1. It contains a number of waste disposal areas as well as two sewage lagoons constructed in 1969 and used until 1973 (Figure 3). The Air Force and the Village of Rantoul have developed an integrated waste management system making the lagoons obsolete. After being abandoned, the lagoons were refilled in 1978 and stocked with fish for use by base personnel until closing in early 1983.

Adjacent to the lagoons on the west and south are three old landfill sites, the last of which was closed in 1970. Liquid sludge from the sewage plant was also disposed near the north dike in 1976.

### Scope of Investigation

Based on the site description and the projected land use, there are three major concerns. First, adequate water quality for a fishery must be ensured in light of the previous land uses. Second, the soils in the area must be able to hold a fairly large, deep body of water without high seepage losses. Finally, an adequate water supply is critical because the lake will not be fed by its surrounding watershed to the same extent as natural and most artificial lakes.

### Water Quality

Daily and Associates Engineers, Inc., performed sampling and analysis for water quality. Four types of samples were taken: water from the lagoons; sediments on the bottom of the lagoons; topsoil on the landfills; and water from monitoring wells installed in borings adjacent to the landfills. Table 1 lists the chemical constituents for which the samples were analyzed. The lagoon water met State of Illinois General Water Quality Standards. Lagoon sediments and landfill topsoil contained no constituents higher in concentration than normal background concentrations in Central Illinois. Moreover, water drawn from the monitoring wells contained no constituents higher in concentration than permitted by Illinois General Water Quality Standards.

The following recommendations have been incorporated into the recreation area's design. Lake construction must not disturb the landfills. In addition, landfills will be graded to minimize rainfall percolation, thus reducing chances of contamination from landfill contents through the groundwater table. The lake's water surface will be maintained above ground level to minimize groundwater migration. Finally, closed buildings will not be situated on the landfills; therefore, gases released from refuse decomposition cannot accumulate and create hazards.

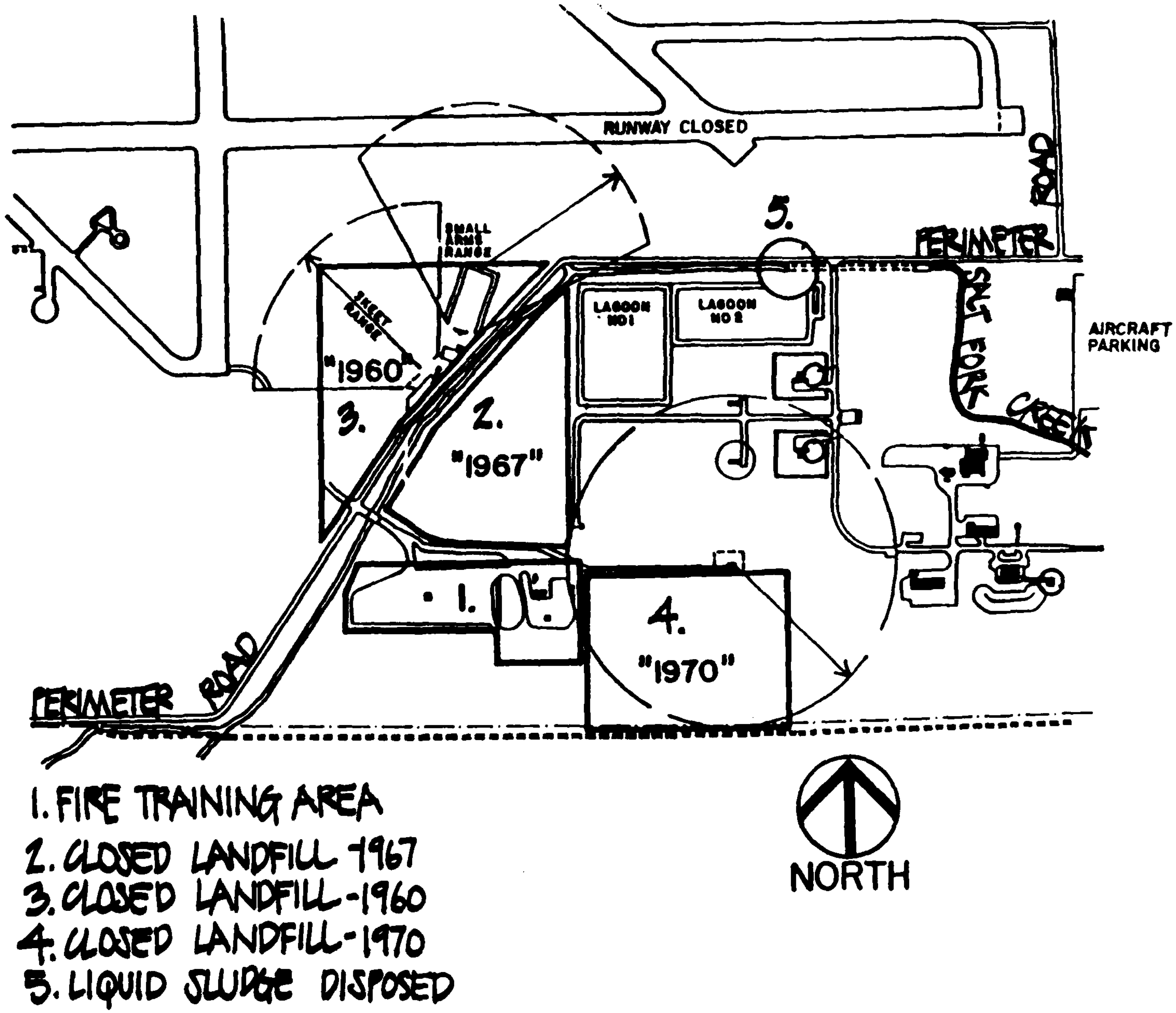


Figure 3. Existing site.

Table 1

Chemical Constituents Analyzed for Water Quality Assessment

Lagoon Sediments and Landfill Topsoil:

| | |
|---|---|
| Phenol | Total PCB |
| Cyanide | p,p-DDT |
| Arsenic | o,p-DDT |
| Selenium | Aldrin |
| Cadmium | Chlordane |
| Chrome | Dieldrin |
| Nickel | Endrin |
| Lead | Heptachlor |
| Zinc | Heptachlor epoxide |
| Mercury | Lindane |
| Silver | Methoxychlor |
| Barium | Toxaphene |
| | Parathion |

Lagoon and Monitoring Well Water:

| | |
|---|---|
| All of the above plus | Specific conductivity |
| | pH |
| | Total organic halogens (TOX) |
| | Total organic carbon (TOC) |

## Soils Investigation

Five exploratory soil borings were made at the lake expansion site. One to two feet of black, silty clay topsoil covers the area. Beneath the topsoil is a yellow-brown, silty clay loess layer that varies in thickness from 3 to 6 ft. Below the loess is a weathered glacial till consisting of yellow-brown, silty clay with pebbles (averaging 8-1/2 ft to 12-1/2 ft below the surface). An unweathered till of gray, silty clay is below the weathered till.

The borings also revealed a number of sand layers, varying in thickness from a few inches to several feet. These layers did not seem continuous between borings and were therefore termed sand lenses (localized pockets of sand).

These results indicate that construction of a lake is feasible because the glacial till should make an excellent seal. Sand lenses at the lake's grade level will be sealed or removed.

## Water Supply

The water level in the lake will be controlled by the amount of seepage through the bottom and sides and by the availability of a water supply to compensate for both evaporative and seepage losses. Since the lake will be constructed with the surface above ground level, very little water will drain in from the surrounding watershed. Thus, direct precipitation on the surface of

the lake plus additions from the artificial recharge system will serve as the water supply.

*Seepage*

Seepage from the lake will depend on two major factors: (1) the quality of the seal in the lake and (2) the difference in height between the lake's surface and the groundwater level. There should be an adequate supply of cohesive soils (silt and clay) at the site to seal the lake bottom and sides, with the quality of the seal depending primarily on how well sand lenses are dealt with. Thus, careful compaction of the bottom and sides of the lake will be important.

The possibility also exists that farmland drainage tiles from the surrounding area will be found during excavation. Tiles still operating cannot simply be plugged because if the tiles drain into the lake, water will backup and the fields will not drain properly; if they drain away from the lake, they will let water seep out of the lake. Thus, functional tiles must be rerouted around the lake.

Glacial till can be highly variable. It is generally an unconsolidated sediment that can contain all sizes of fragments from clay to boulders and is deposited by glacial action. Based on the literature values for glacial till draining properties, estimates were made for lake seepage. These estimates can be considered worst-case, because the till at the site is primarily silt and clay and should have permeabilities lower than general literature values.

The governing equation for determining the seepage rate in such situations is Darcy's Law.[1] As described by Harr,[2] Darcy's Law is:

$$Q = \frac{k \Delta h A}{\Delta \ell} \qquad \text{[Eq 1]}$$

where:
- $Q$ = flow in gallons per day (gpd)
- $k$ = hydraulic conductivity (velocity or coefficient of permeability) in gpd/sq ft
- $\Delta h$ = hydraulic head (ft)
- $\Delta \ell$ = length (ft)
- $A$ = area of flow (sq ft)

1 Adrian Visocky, Illinois State Water Survey, personal communication.
2 M. E. Harr, Groundwater and Seepage (McGraw-Hill Book Co., Inc., 1962).

and where typical values of k are:

| | | | |
|---|---|---|---|
| Clean gravel | | $\geq$ | 21200 gpd/sq/ft |
| Clean sand (coarse) | 212 | to | 21200 |
| Sand (mixture) | 106 | to | 212 |
| Fine sand | 21.2 | to | 106 |
| Silty sand | 2.1 | to | 42.4 |
| Silt | 10.6 | to | 0.21 |
| Clay | | $\leq$ | 0.021 |

Figure 4 is a schematic of seepage estimates.

The value of k for compacted clay, as used to line landfills, is approximately .0021 gpd/sq ft and that of glacial till in general is .01 gpd/sq ft.[3] The most appropriate value for the lake is probably somewhere between these, since the till is fairly small-grained but not quite on the order of compacted clay.

<u>Calculation 1</u>. Assuming that:

$k$ = .0021 gpd/sq ft

$A$ = 20 acres (surface area of lake) = 871,200 sq ft

$\Delta h$ = 6 ft (will vary according to height of water table, which fluctuates seasonally)

$\Delta \ell$ = 1 ft (since sand lenses may be slightly below the lake bottom at various locations)

Then:

$$Q = (.0021 \text{ gpd/sq ft})\left(\frac{6 \text{ ft}}{1 \text{ ft}}\right)(871{,}200 \text{ sq ft})$$

$$Q = 11{,}000 \text{ gpd}$$

$$Q = 7.6 \text{ gpm}$$

<u>Calculation 2</u>. Assuming that:

$k$ = .01 gpd/sq ft

$A$ = 871,200 sq ft

$\Delta h$ = 6 ft

$\Delta \ell$ = 1 ft

Then:

$$Q = (.01 \text{ gpd/sq ft})\left(\frac{6 \text{ ft}}{1 \text{ ft}}\right)(871{,}200 \text{ sq ft})$$

$$Q = 52{,}270 \text{ gpd}$$

$$Q = 36 \text{ gpm}$$

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[3] Adrian Visocky, personal communication.

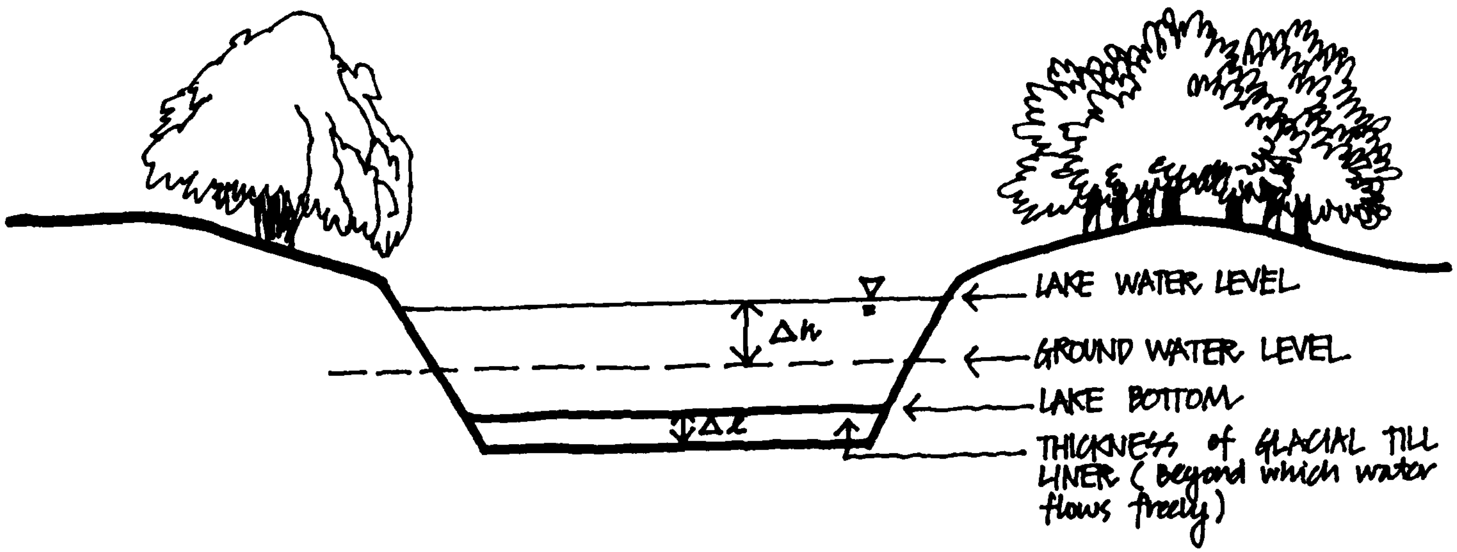


Figure 4. Schematic for lake seepage.

Calculation 2 is a liberal estimate but is still an approximation. Adrian Visocky of the Illinois State Water Survey recommended the "ballpark" figure of 50 gpm for safety. This also allows for some slight losses through the dikes (lateral migration). Calculation 3 is an estimate of these losses.

Calculation 3. Assuming that:

$k = 0.01$ gpd/sq ft

circumference of lake = 6600 ft (twice the circumference of a circular lake of 20 acres)

$A = (6600 \text{ ft})(5.5 \text{ ft}) = 36{,}300$ sq ft (assumes the average dike height is 5.5 ft)

Then:

$$Q = (.01 \text{ gpd/sq ft})\left(\frac{6 \text{ ft}}{1 \text{ ft}}\right)(36{,}300 \text{ sq ft})$$

$$Q = 2178 \text{ gpd}$$

$$Q = 1.5 \text{ gpm}$$

If the 50 gpm is calculated in terms of water level drop per year:

$$50 \text{ gpm} = 72{,}000 \text{ gpd}$$

$$\frac{72{,}000 \text{ gpd}}{871{,}200 \text{ sq ft}} = 0.083 \text{ gpd/sq ft}$$

$$(0.0083 \text{ gpd/sq ft})(1 \text{ cu ft}/7.481 \text{ gal}) = 0.011 \text{ ft/day}$$

$$(0.011 \text{ ft/day})(365 \text{ days/year}) = 4.02 \text{ ft/year}$$

This means the lake would drop approximately 4 ft over the course of a year from seepage losses alone, without addition of water from precipitation or a recharge system.

For comparison, the U.S. Soil Conservation Service handbook on pond construction notes that seepage losses can vary widely — as little as 1 to 2 ft per year in slowly permeable soils to greater than 4 ft per year in more permeable soils.[4]

Although the borings indicate adequate amounts of fine-grained till, the sand lenses may require large amounts of sealant. If necessary, additional material can be transported from elsewhere on the base or from some off-base site. Again, care in excavation and compaction will lower seepage losses dramatically.

[4] U.S. Soil Conservation Service, Building a Pond, Farmers Bulletin No. 2256 (U.S. Department of Agriculture, 1973).

*Evaporation*

Annual evaporation for Central Illinois is approximately equal to the annual precipitation. Evaporative losses in lakes can be a problem, however, due to the temporal variability in evaporative rates over the course of the year and the occurrence of drought periods. Table 2 demonstrates that, on an average, the months of June through September show a net evaporative loss (evaporation minus precipitation). The total is only 4.3 in., which does not represent much of a problem for the lake. These data are for Urbana, Illinois, and represent the closest available long-term record.

Caution must be exercised when dealing with climatological data, because there is much variability between years. Table 3 is from the Illinois State Water Survey and shows the maximum net evaporation from a lake surface at Urbana expected for any one period (in months) for any specific recurrence interval (years). For example, every 10 years the maximum drawdown in the lake is 12.7 in. This would occur over a 6-month period and represents only evaporative losses; seepage would increase the drawdown. As the interval increases, the maximum drawdown increases accordingly. These dry periods make lake level maintenance a problem, particularly when combined with the seepage losses.

The magnitude of this problem also depends on the tolerance range for the level of the lake. According to Gary Lutterbie of the Illinois Department of Conservation, a 1- to 2-ft drawdown from the maximum level is allowed at many Department of Conservation lakes and appears to present no problem for lakes larger than several acres.[5] Since the estimate for seepage losses is liberal and it is likely there will be an adequate supply to meet those needs, maintaining the lake level should be a problem only during dry periods. If evaporative losses become excessive and the lake is being drawn down too far, emergency procedures can be instituted. For example, a fire hydrant adjacent to the site can provide substantial water flows. The major problems resulting from drawdown are with esthetics and access, i.e., exposed muddy areas along the shore are unattractive and make it more difficult to fish.

*Water Supply System*

When previously used for fishing, the lagoons were fed by a 2-in. pipe from the base's water supply. The groundwater in the area is of good quality and requires no treatment beyond chlorination for human consumption. This chlorinated groundwater appears to have been adequate in quality for supplying lagoons, since the chlorine became diluted rapidly and was then destroyed by ultraviolet radiation in sunlight.

If the base did not have an adequate water supply, the best alternative would be to dig a well near the site. This is an option for the future, but for the present, the most economical solution is to use the base's water supply. Specifically, a pipe large enough for at least 50 gpm at average pressure in the water lines will be necessary. Since the water will be chlorinated and probably low in dissolved oxygen content, a rocky outfall is needed.

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[5] Gary Lutterbie, Regional Fisheries Biologist, Illinois Department of Conservation, personal communication.

Table 2

Mean Net Evaporation from a Lake Surface at Urbana, Illinois, in Inches (1930 to 1960)*

| | Evap | | Precip | | Mean Net Evaporation |
|---|---|---|---|---|---|
| January | 0.31 | - | 2.16 | = | -1.85 |
| February | 0.61 | - | 2.09 | = | -1.48 |
| March | 1.39 | - | 3.17 | = | -1.78 |
| April | 2.68 | - | 3.54 | = | -0.86 |
| May | 4.00 | - | 4.22 | = | -0.22 |
| June | 4.85 | - | 4.54 | = | 0.31 |
| July | 5.50 | - | 3.49 | = | 2.01 |
| August | 4.71 | - | 3.04 | = | 1.67 |
| September | 3.31 | - | 3.04 | = | 0.27 |
| October | 2.01 | - | 3.01 | = | -1.00 |
| November | 0.82 | - | 2.62 | = | -1.80 |
| December | 0.33 | - | 2.08 | = | -1.75 |

*Precipitation data reprinted with permission from W. L. Denmark, "Climate of Illinois," in J. A. Ruffner (ed.), Climates of the States (Gale Research Co., 1978); Evaporation data reprinted with permission from W. J. Roberts and J. B. Stall, Lake Evaporation in Illinois, Report of Investigation 57 (Illinois State Water Survey, 1967).

Table 3

Maximum Net Evaporation from a Lake Surface at Urbana, Illinois, in Inches*

| Duration in Months | Recurrence Interval in Years | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 15 | 20 | 25 | 30 |
| 1 | 0 | 4.38 | 4.77 | 5.06 | 5.43 | 5.58 | 5.62 | 5.76 | 5.81 | 5.82 | 5.83 |
| 2 | | 6.5 | 7.2 | 7.4 | 7.4 | 8.7 | 9.1 | 10.9 | 11.4 | 11.4 | 11.4 |
| 3 | | 7.8 | 8.7 | 10.4 | 10.6 | 11.0 | 11.6 | 11.8 | 12.3 | 12.8 | 13.2 |
| 4 | | 8.7 | 10.5 | 10.8 | 11.7 | 12.4 | 12.7 | 13.7 | 14.1 | 14.2 | 14.2 |
| 5 | | 8.8 | 10.6 | 11.8 | 12.3 | 12.5 | 12.7 | 13.1 | 13.9 | 14.9 | 15.7 |
| 6 | | 9.1 | 10.4 | 11.0 | 11.8 | 12.2 | 12.7 | 13.3 | 14.3 | 15.6 | 16.6 |
| 7 | | 8 | 9 | 10 | 11 | 11 | 12 | 13 | 15 | 16 | 18 |
| 8 | | 7 | 8 | 9 | 10 | 11 | 11 | 14 | 16 | 17 | 18 |
| 9 | | 4 | 7 | 8 | 9 | 10 | 11 | 13 | 15 | 17 | 18 |
| 10 | | 3 | 5 | 6 | 7 | 9 | 10 | 13 | 15 | 16 | 17 |
| 11 | | 1 | 4 | 5 | 5 | 7 | 9 | 13 | 15 | 16 | 16 |
| 12 | | 0 | 4 | 5 | 5 | 9 | 11 | 13 | 14 | 15 | 16 |
| 14 | | | 6 | 6 | 7 | 8 | 9 | 15 | 18 | 20 | 21 |
| 16 | | | 0 | 5 | 8 | 10 | 11 | 14 | 17 | 20 | 23 |
| 18 | | | | 1 | 7 | 10 | 12 | 14 | 18 | 22 | 26 |
| 20 | | | | 0 | 5 | 7 | 7 | 13 | 18 | 21 | 24 |
| 22 | | | | | 3 | 3 | 5 | 11 | 15 | 18 | 21 |
| 24 | | | | | 0 | 1 | 3 | 8 | 13 | 16 | 19 |
| 26 | | | | | | 2 | 5 | 7 | 10 | 14 | 20 |
| 28 | | | | | | 0 | 4 | 10 | 15 | 20 | 25 |
| 30 | | | | | | | 2 | 8 | 14 | 20 | 26 |
| 32 | | | | | | | 0 | 7 | 12 | 16 | 21 |
| 34 | | | | | | | | 2 | 7 | 12 | 19 |
| 36 | | | | | | | | 0 | 0 | 11 | 19 |
| 38 | | | | | | | | | 8 | 14 | 23 |
| 40 | | | | | | | | 0 | 8 | 14 | 24 |
| 42 | | | | | | | | | 7 | 15 | 26 |
| 44 | | | | | | | | | 0 | 9 | 23 |
| 46 | | | | | | | | | | 3 | 14 |
| 48 | | | | | | | | | | 10 | 21 |
| 50 | | | | | | | | | | 17 | 24 |
| 52 | | | | | | | | | | 21 | 29 |
| 54 | | | | | | | | | | 20 | 28 |
| 56 | | | | | | | | | | 16 | 25 |
| 58 | | | | | | | | | | 0 | 0 |
| 60 | | | | | | | | | | | |

*Reprinted with permission from W. J. Roberts and J. B. Stall, Lake Evaporation in Illinois, Report of Investigation 57 (Illinois State Water Survey, 1967).

A winding stream leading to the lake would be most effective and can be designed with a pleasing appearance.

According to water supply personnel for the base, water usage has dropped by 300,000 gpd (208 gpm) since the water was shut off for the lagoons. Since our estimates are for only 25 percent of this amount (50 gpm), there should be no problem in using water from the base as an artificial recharge system.

## 4 LAKE PLANNING

This unique site will require careful planning for the recreation lake. Potential environmental hazards must be minimized and the lake must be constructed to maximize its capacity for supporting a quality fishery. In this regard, there are a number of considerations: site preparation, physical layout of the lake, water supply, water quality, erosion control, and provisions for managing the fishery.

### Site Preparation

To prepare for lake construction, the existing fish population in the lagoons must be completely removed (by complete draining or poisoning). This procedure prevents interference with stocking plans by rough (undesirable) species.

### Physical Dimensions and Water Level

The surface area of the lagoons is approximately 10 acres. It was decided to work with the configuration of these lagoons in developing the lake (see Figures 5 and 6). This is advantageous in that the lagoons were constructed to have the water surface several feet above ground level, thereby reducing excavation requirements. Two important criteria in designing lakes for fishing are a reasonable depth distribution and shoreline development. In the Midwest, it is essential to have at least 25 percent of a lake's surface area greater than 9 ft deep to maintain fish populations over winter. In addition, a variety of depths must exist throughout the lake. Shallow areas (especially less than 4 ft deep) are important for spawning and rearing of the young fish, but should be restricted to immediate shorelines to prevent problems with aquatic plants. Adults must be able to migrate from deep refuges to shallower areas for feeding. This variation in depth can be more effective if the lake shoreline is irregular -- that is, if shoreline development is increased. This provides more "edge" per unit surface area, which translates into greater habitat diversity for the fish community. In addition, one or more islands can provide more shoreline and increase fishing access.

The lake is designed to cover approximately 20 acres. The newly excavated section will contain a high proportion of deep areas (12 to 15 ft) because the lagoons may be difficult to deepen. The water level will be at elevation 732.0 when the existing lake is full, but can be controlled to 729.5 by removing planks in the outlet structure (see Figure 7 for depth information). For a successful fishery, areas less than 5 ft deep should be restricted to the immediate shoreline.

### Water Supply

As the feasibility section indicated, chlorinated groundwater will be used for the recharge system, thus ensuring a reliable, high-quality water source. Construction of a rocky outfall leading to a winding stream for the water source will help aerate the water and remove chlorine through increased exposure to sunlight. For initial filling of the lake, fire hoses will be run

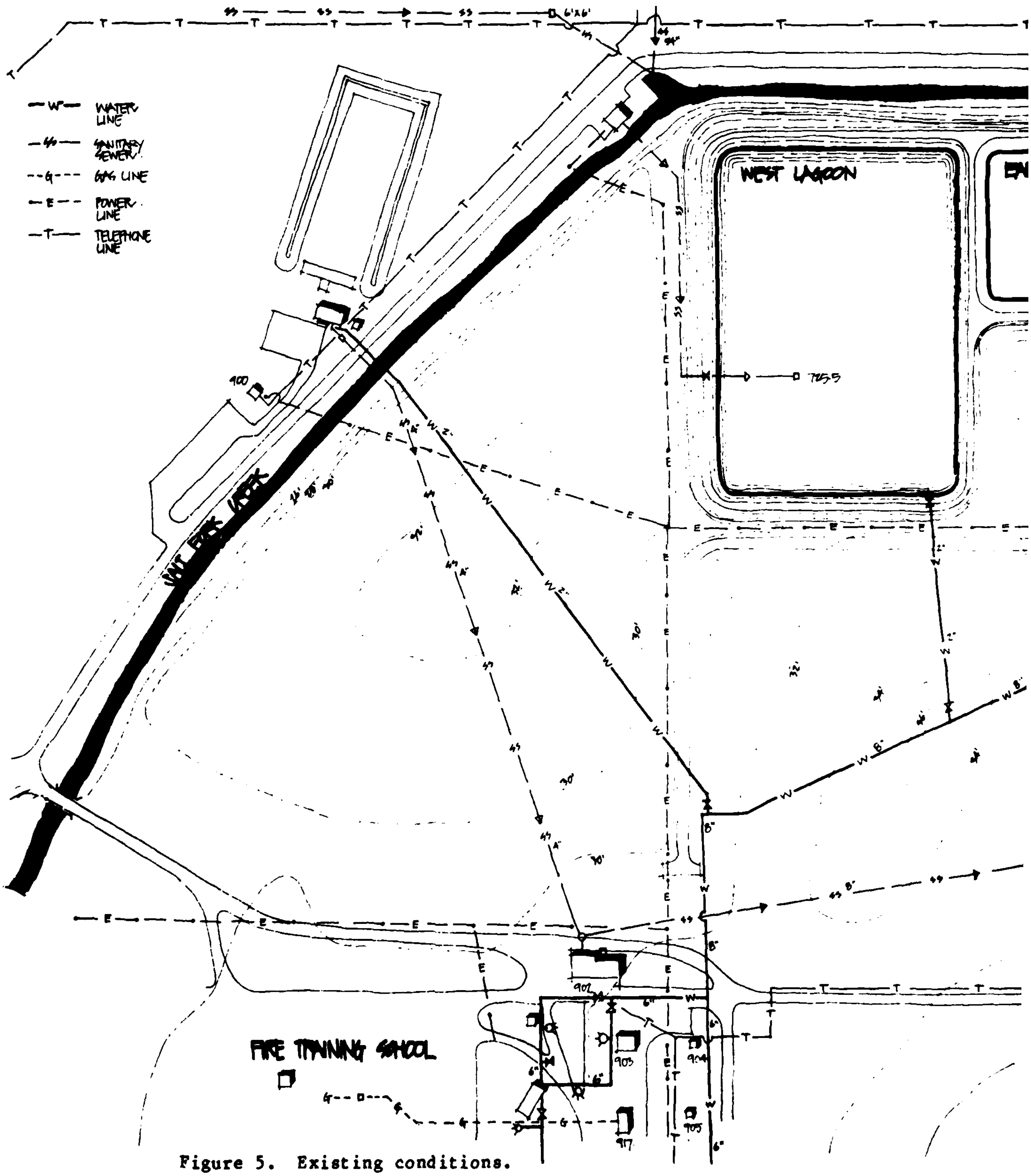
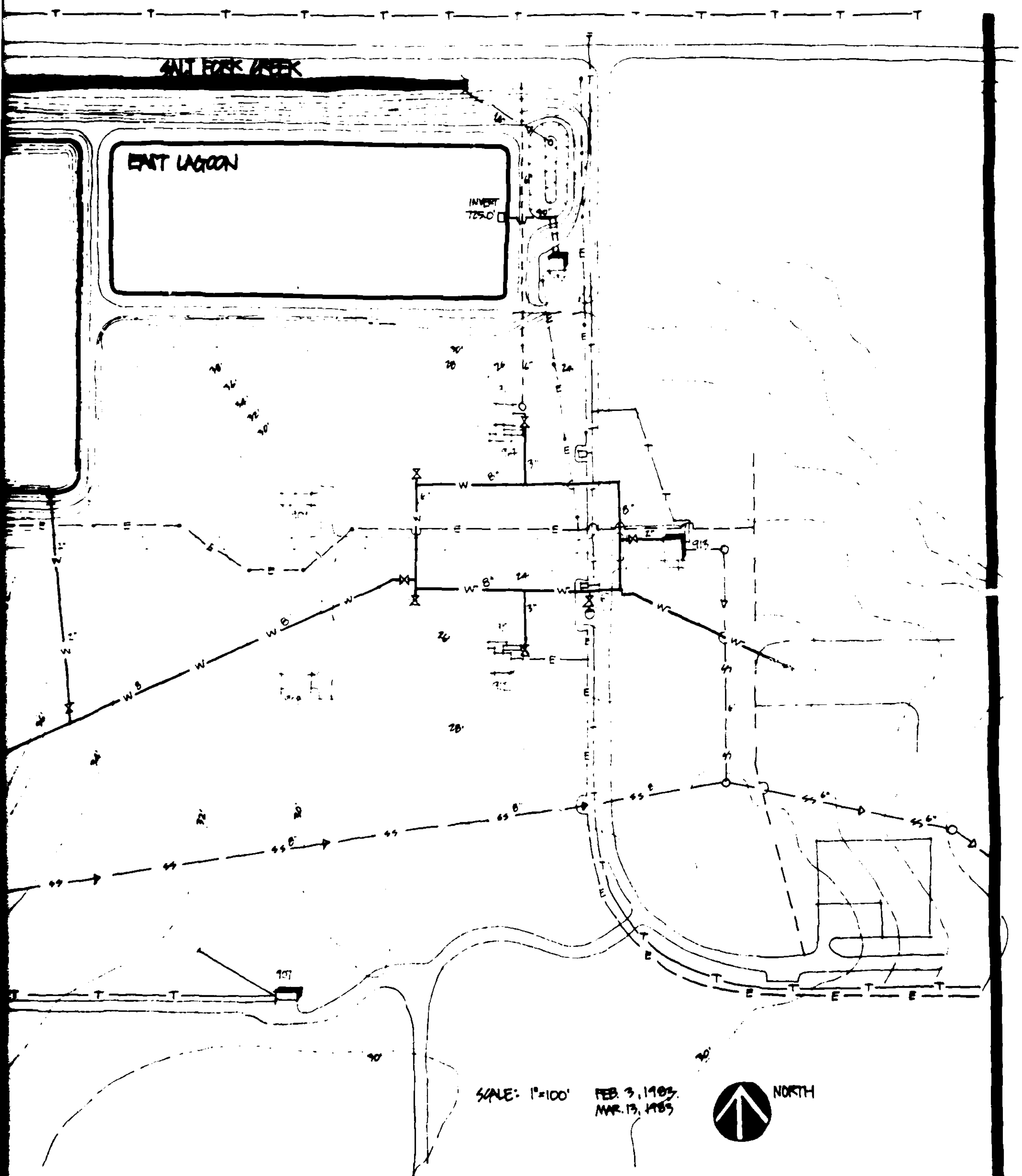



Figure 5. Existing conditions.



SALT FORK CREEK
EAST LAGOON
INVERT
725.0'
SCALE: 1"=100'
FEB. 3, 1983
MAR. 13, 1983
NORTH


2

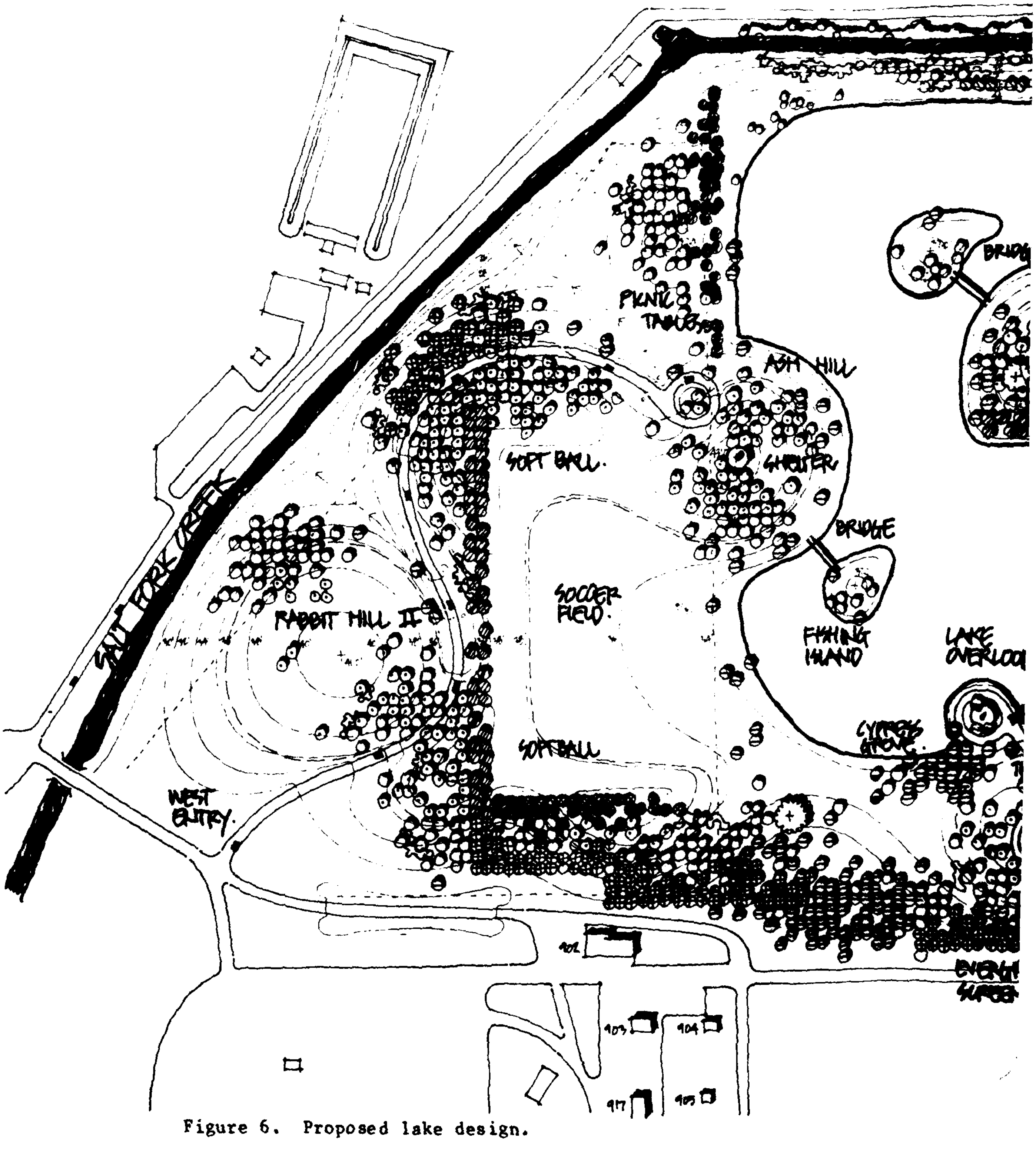
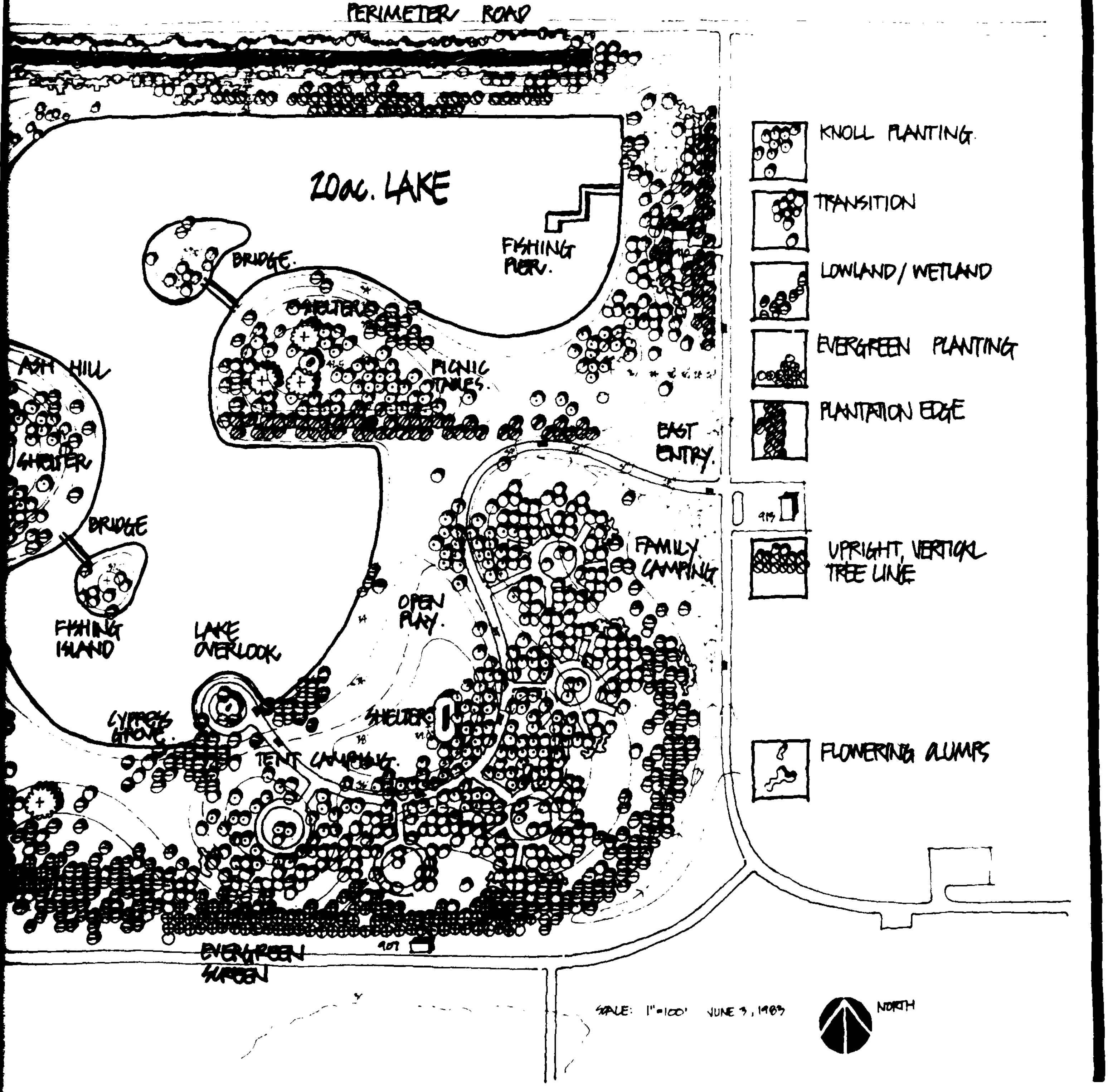



Figure 6. Proposed lake design.


PERIMETER ROAD
20ac. LAKE
FISHING PIER.
BRIDGE.
SHELTERS
PICNIC TABLES.
ASH HILL
SHELTER
BRIDGE
FISHING ISLAND
LAKE OVERLOOK
EAST ENTRY.
FAMILY CAMPING
OPEN PLAY.
CYPRESS GROVE.
SHELTERS
TENT CAMPING.
EVERGREEN SCREEN
KNOLL PLANTING.
TRANSITION
LOWLAND/WETLAND
EVERGREEN PLANTING
PLANTATION EDGE
UPRIGHT, VERTICAL TREE LINE
FLOWERING CLUMPS
SCALE: 1"=100' JUNE 3, 1983
NORTH

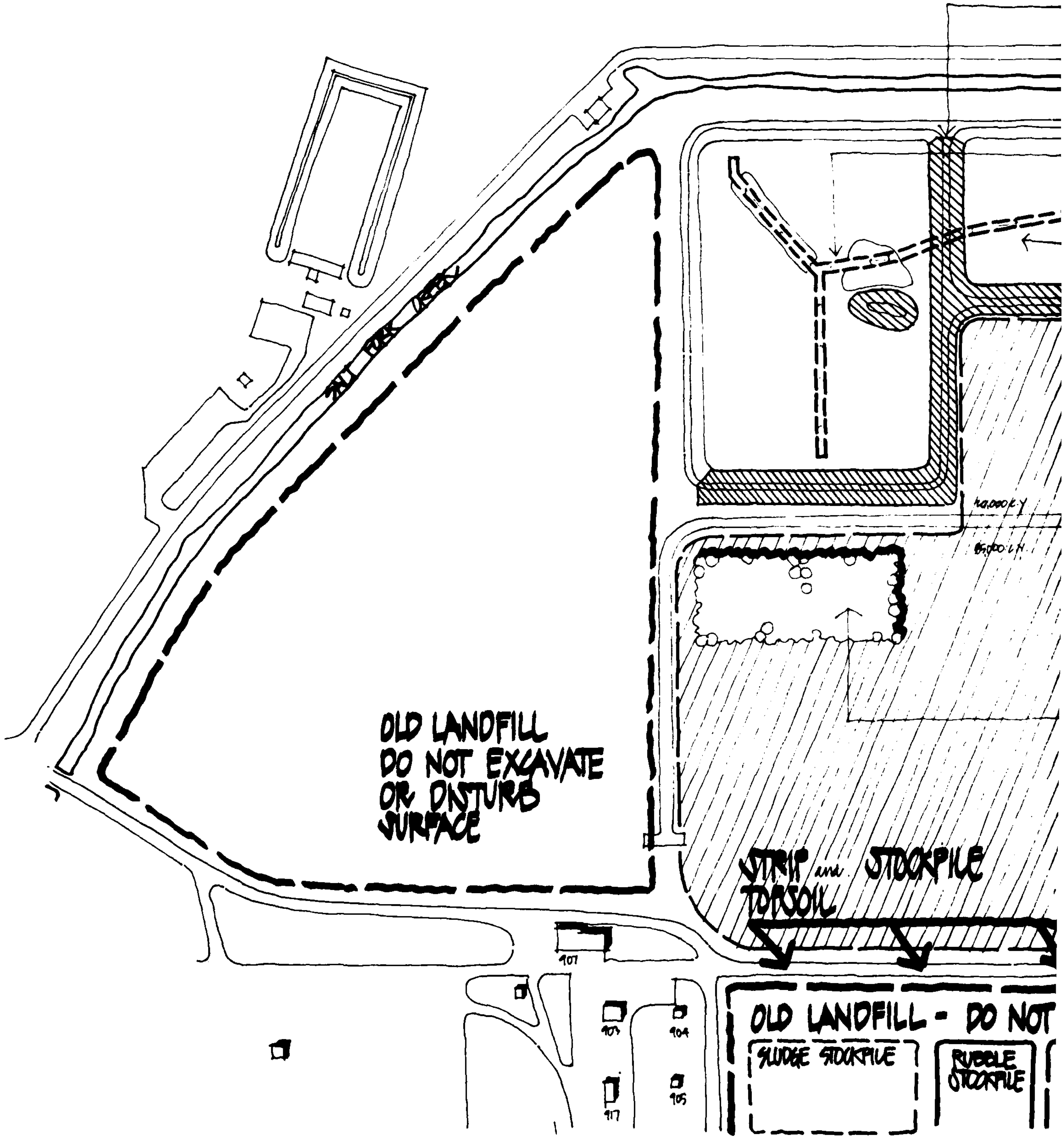
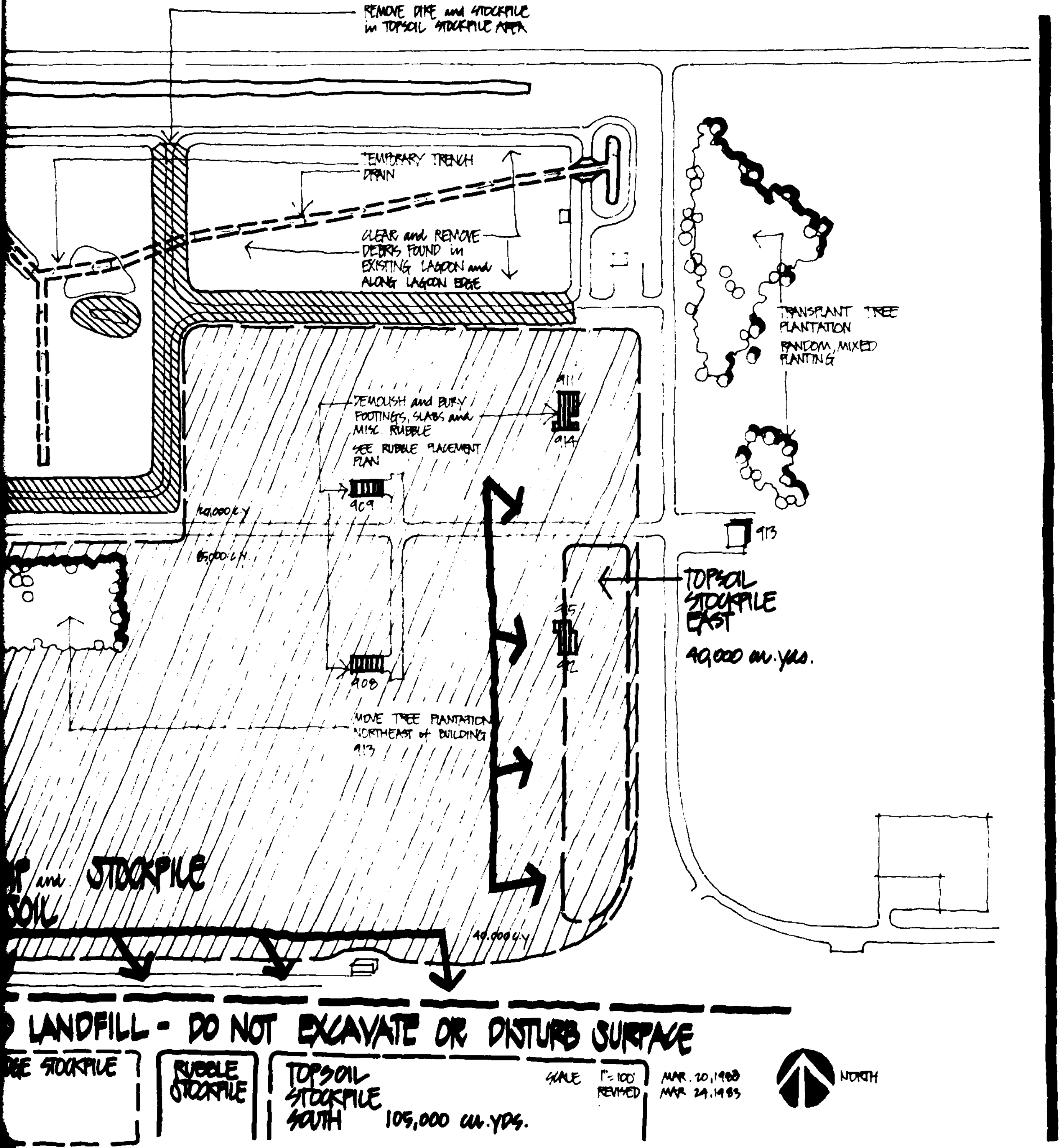



Figure 7. Site preparation.


REMOVE DIKE and STOCKPILE in TOPSOIL STOCKPILE AREA
TEMPORARY TRENCH DRAIN
CLEAR and REMOVE DEBRIS FOUND in EXISTING LAGOON and ALONG LAGOON EDGE
TRANSPLANT TREE PLANTATION
RANDOM, MIXED PLANTING
DEMOLISH and BURY FOOTINGS, SLABS and MISC RUBBLE
SEE RUBBLE PLACEMENT PLAN
911
914
909
908
913
40,000 c.y.
65,000 c.y.
TOPSOIL STOCKPILE EAST
40,000 cu. yds.
MOVE TREE PLANTATION NORTHEAST of BUILDING 913
and STOCKPILE
SOIL
40,000 c.y.
LANDFILL - DO NOT EXCAVATE OR DISTURB SURFACE
GE STOCKPILE
RUBBLE STOCKPILE
TOPSOIL STOCKPILE SOUTH 105,000 cu. yds.
SCALE 1" = 100'
REVISED
MAR. 20, 1983
MAR. 24, 1983
NORTH

to the site from adjacent fire hydrants; afterwards, the single supply line should suffice (except possibly during droughts -- see feasibility section).

The water supply should be regulated to keep the lake as full as possible, which requires either a remote water level sensing device or regular level checks by qualified individuals. Since some drawdown is acceptable (depending on the shoreline configuration), monitoring will not be extremely critical. Nevertheless, the best solution might be an automatic sensing and switching device that would eliminate guesswork and only add water when necessary.

## Water Quality

The central Illinois climate will restrict the lake population to warmwater fish. Excluding temperature, the primary water quality limitations will depend on the levels of contaminants, nutrients, dissolved oxygen, turbidity, and residual chlorine.

The primary environmental hazard at this site is contaminant migration from the adjacent landfills into the lake. This danger will be minimized by the seepage-resistant glacial till and by the positive hydraulic head that results from having the lake surface above groundwater levels.

Fertility for aquatic communities is primarily measured in terms of phosphate and nitrogen levels -- the two nutrients usually in shortest supply. Typically lakes in this region (east central Illinois) have adequate or excess nutrient input from the surrounding watershed. Nutrients for this lake may be in short supply since the lagoons will be dredged and runoff from the watershed will be minimal. This situation is easily corrected by adding readily available soil fertilizers. In fact, a shortage is preferable to nutrient excess, since correcting an imbalance by removing excess nutrients is difficult and requires regular treatment.

Newly excavated ponds with raw clay basins are often poor fish-supporting waters. However, fertilization to promote plant life must be stopped before nuisance species overtake beneficial ones. According to George Bennett, "the addition of several hundred pounds per acre of commercial fertilizer during the first year will improve fish production without creating nuisance vegetation problems in later years."[6]

Although the results of various studies on the effects of adding fertilizer to lakes vary widely, a general rule is to maintain total phosphorus levels of approximately 0.05 ppm. Levels higher than this may allow algal blooming, whereas levels considerably lower may result in smaller fish populations because of limited food.

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[6] G. W. Bennett, Management of Lakes and Ponds, 2nd Ed. (Van Nostrand Reinhold Co., 1971).

If possible, water samples should be analyzed for nitrogen and phosphorus after the lake is constructed. With these data, the Department of Conservation can make more specific recommendations for fertilizing the lake.

Dissolved oxygen is normally maintained at adequate levels (greater than 5 ppm) by algae photosynthesis and exchange with the atmosphere. Three sets of circumstances can cause an imbalance. First, if the lake becomes eutrophic (i.e., has an excess of plant nutrients), then rapid algal growth can produce blooms. These blooms are unsightly and can lower oxygen levels rapidly when the algae die and decompose. This lake should not experience eutrophication due to its lack of watershed nutrient influx. Another situation that can lower oxygen levels enough to affect fish is ice cover in the winter. Ice prevents atmospheric reaeration and, if snow covers the ice, algae may not receive enough light to photosynthesize and supply dissolved oxygen. This is another reason for providing large areas with greater than 9-ft depth, because water that deep probably will not freeze and should contain enough oxygen to maintain fish throughout the winter. A third potential problem is with low dissolved oxygen levels in the feedwater, but this should be circumvented by the rocky outfall.

Turbidity -- the presence of suspended sediment particles in water -- also influences lake quality by producing a murky appearance. It affects fish by reducing their visibility, which disrupts feeding and other survival activities. Turbidity will not be a problem if shoreline erosion is controlled (since that should be the only source of new sediment) and if rough fish such as carp (which roil up the lake bottom and resuspend sediments) are kept out. Shoreline erosion can be prevented by proper lake design (see the next section); regulations for preventing carp infiltration are discussed in Chapter 7.

Residual chlorine from the feedwater should be minimized since it can be harmful to fish. Fortunately, chlorine breaks down rapidly when exposed to sunlight, so with the precautions planned for the outfall, residual chlorine should be no problem. In addition, the lagoons were fed by chlorinated groundwater for several years previously and maintained a fish community with no evidence of poisoning.

## Erosion Control

Since sediment from the lake shoreline can affect water quality as well as esthetics and fishing access, it is important to control bank erosion. Although waves caused by wind can be destructive, foot traffic erosion along the shoreline may assume greater importance at this site. This is true for most heavily used Department of Conservation lakes. The banks can be stabilized with some sort of rock (riprap or gravel) to prevent significant erosion in an unobjectionable way. Confining traffic to a graveled path and protecting the east and north shores especially well (since prevailing winds are from the south and west) should prevent erosion.

## Management Provisions

A boat launching ramp is needed for proper lake management. In addition, the capacity for drawing down (lowering) the lake, which already exists in the lagoons, should be maintained. The outlet structure in the east lagoon will be able to lower the lake to elevation 729.5, and pumps are available for removal of as much water as necessary.

Unless a qualified fishery manager can be hired to oversee operations at the lake, the best option is to take advantage of the local expertise from the Illinois Department of Conservation. These experts manage fish populations at hundreds of lakes throughout the state and will provide fish for stocking as well as support for managing the recreation lake.

# 5 CONSTRUCTION AND DEVELOPMENT

Major construction and development activities for the recreation lake project will be phased over 3 years as summarized below.

First Year -- Horizontal Work (1983)

Add utilities (see Figures 8 and 9)
Grade lake (see Figures 10 and 11)
Lay riprap
Fill lake
Seed graded areas

Second Year -- Vertical Work (1984)

Services road
Parking areas (on perimeter)
Campsite pads
Utility hookups
Playfield layout
Shelters, picnic tables, restrooms
Boat ramp (for servicing only)
1st Phase tree planting
  Nursery stock
  Lining out stock
Stock lake with fish

Third Year (1985)

2nd Phase structures (fishing piers, island bridges, and play equipment)
2nd Phase tree plantings (nursery stocking)
Supplementary lake stocking

Within the first year's work there are three initial work programs:

1. Site preparation

2. Lake construction

3. Lake filling

Construction scheduling and coordination will be based on the following tasks in this order.

## Site Preparation

1. Street demolition I.
2. Place rubble/burial I (west side).
3. Stockpile road base material.
4. Strip topsoil II.
5. Stockpile topsoil II (east side).
6. Strip topsoil III.

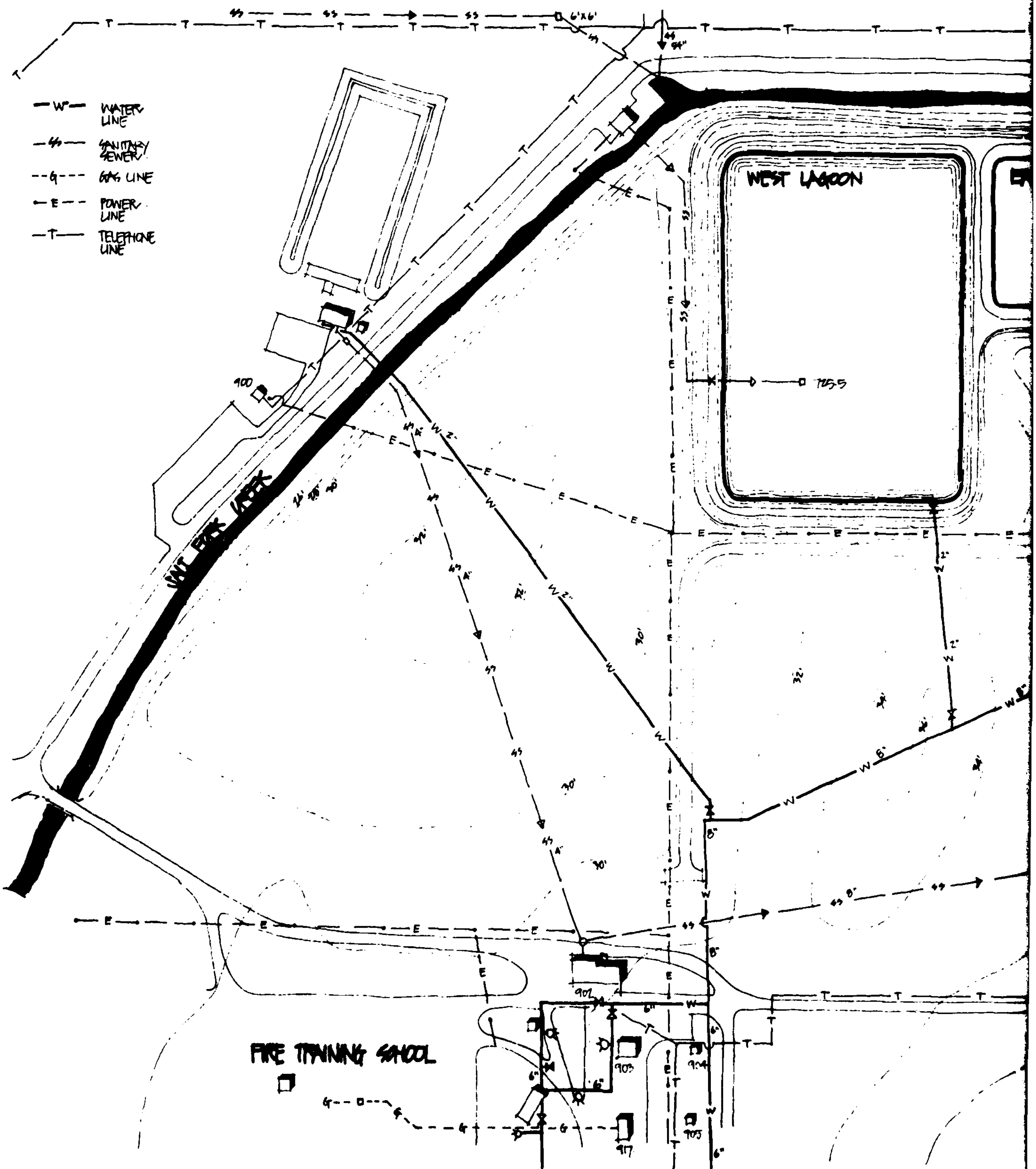
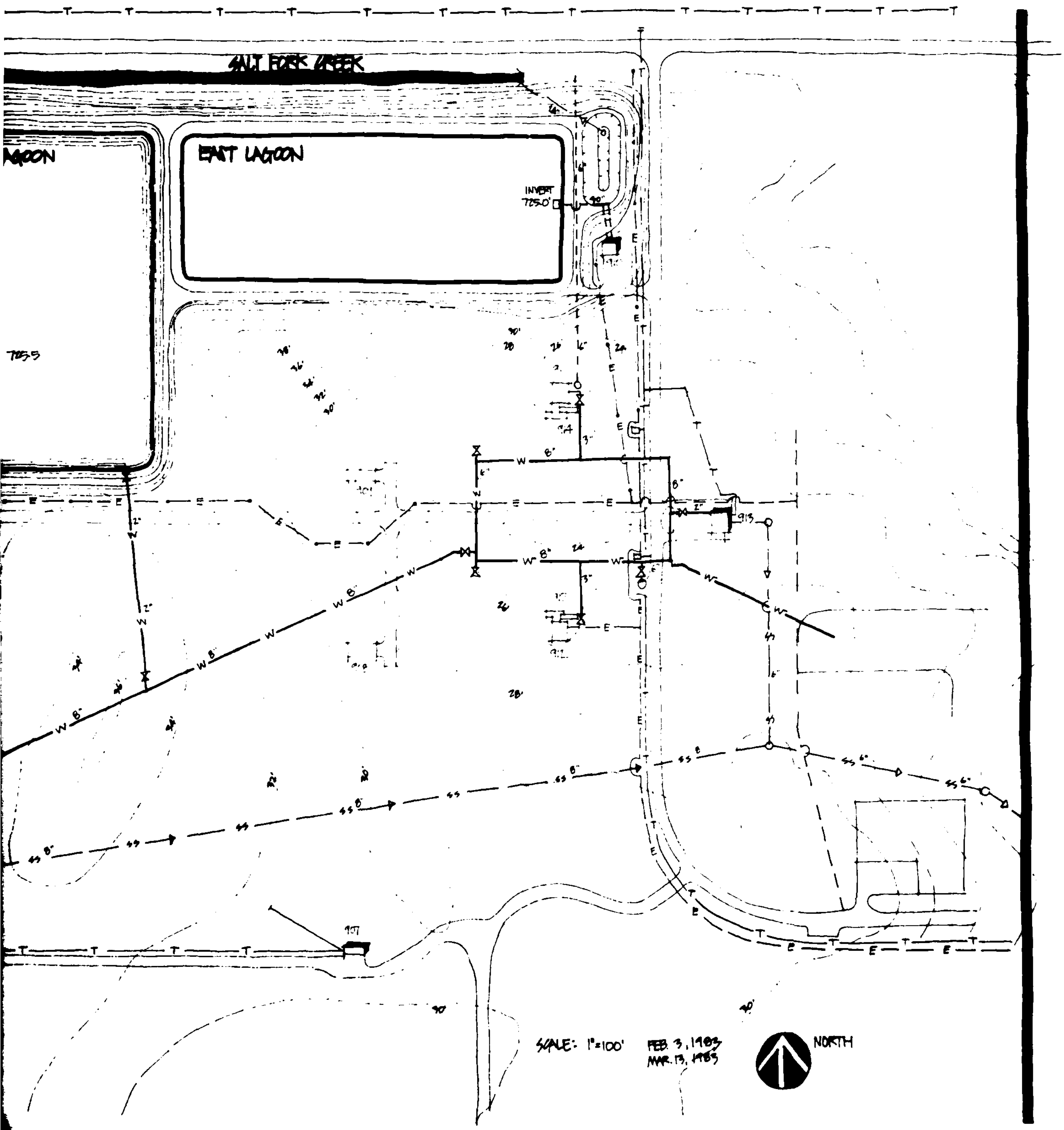



Figure 8. Existing utilities.


SALT FORK CREEK
AGOON
EAST LAGOON
INVERT
725.0'
913
917
SCALE: 1"=100'
FEB. 3, 1983
MAR. 13, 1983
NORTH

1 2

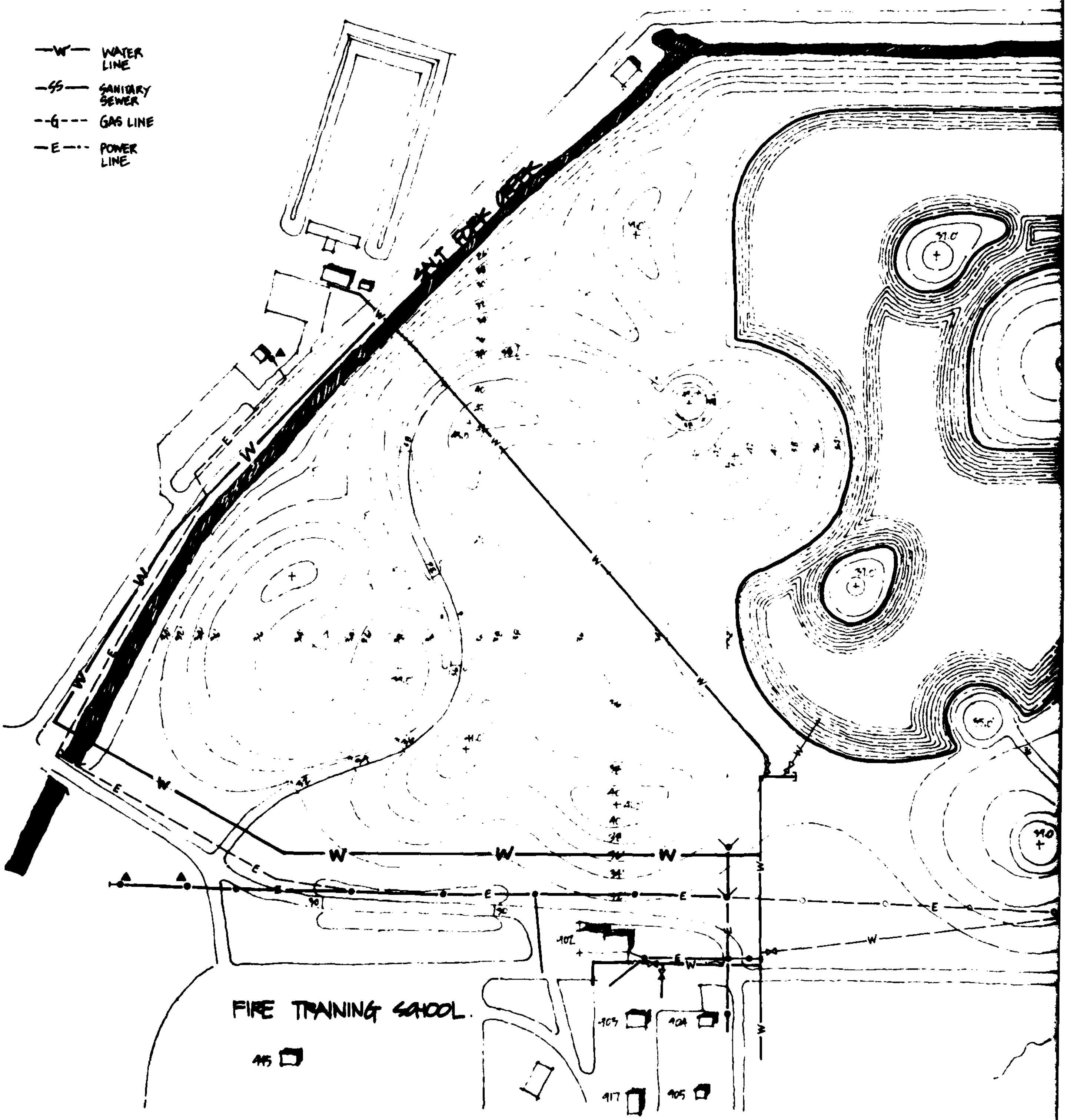
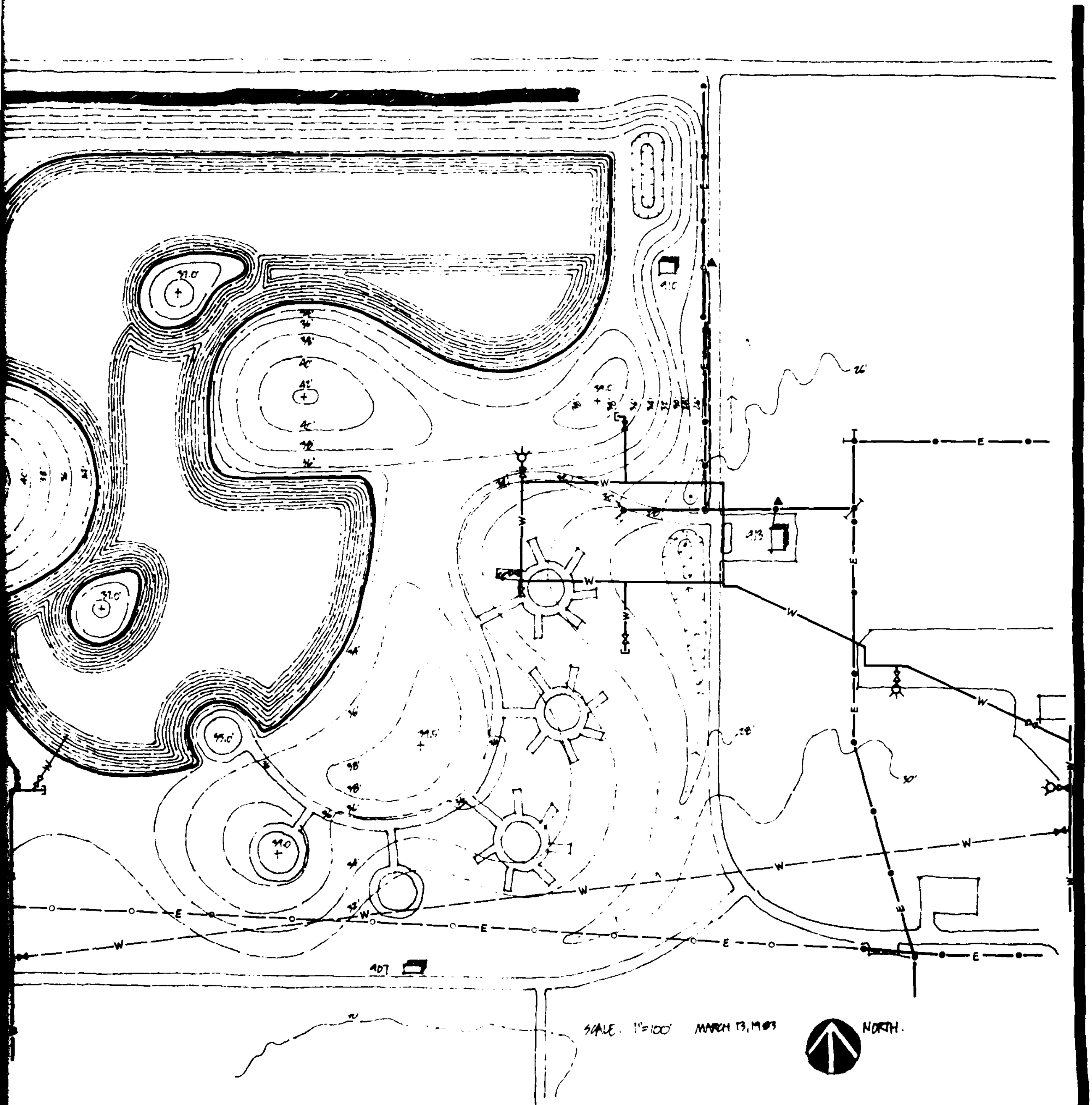



Figure 9. Proposed utilities.




2

7. Stockpile topsoil III (south side of site).
8. Street demolition II.
9. Place rubble/burial II (southeast).
10. Stockpile road base material.
11. Excavate lake to area east.
    Excavate lake to area southeast.
    Excavate lake to area southwest.
    Excavate lake to area west.
12. Rough-grade area east.
    Rough-grade area southeast.
    Rough-grade area southwest.
    Rough-grade area west.
13. Rough-grade lake bottom to drain.
14. Seal lake bottom/sand and gravel lens.
15. Excavate riprap trenches.
16. Street demolition III.
17. Rock crushing I, 9- to 12-in. material.
18. Place riprap I coarse material 9- to 12-in.
19. Rock crushing II, 4-in. material.
20. Fill in riprap II material (4-in.).
21. Place topsoil from stockpile east, 2 ft thick.
22. Place topsoil from stockpile south, 2 ft thick.
23. Grade topsoil stockpile area.
24. Seed stockpile areas.

Lake Filling

1. Sludge placement.
2. Disc-in sludge.
3. Finish grading all disturbed areas.
4. Place fish shelters.
5. Seed all disturbed areas.
6. Fill lake.
7. Check seepage rates.
8. Stock lake.

Upon completion of the first season's construction, detailed plans will be developed for all vertical work. It is especially important to design a family of recreation structures with a consistent design theme to clearly establish a noninstitutional character for this lake and its facilities. The design will use pole timbers for support and buy-out standard park structures that will be carefully modified to create a theme. These structures will include picnic shelters, restrooms, fishing piers, and bridges as well as miscellaneous guard rails, benches, picnic tables, barbecue grills, lighting fixtures, and walkways. Components of this theme will be developed in the second and third construction years.

Figures 10 through 18 show some of the proposed plans for the phases just described.

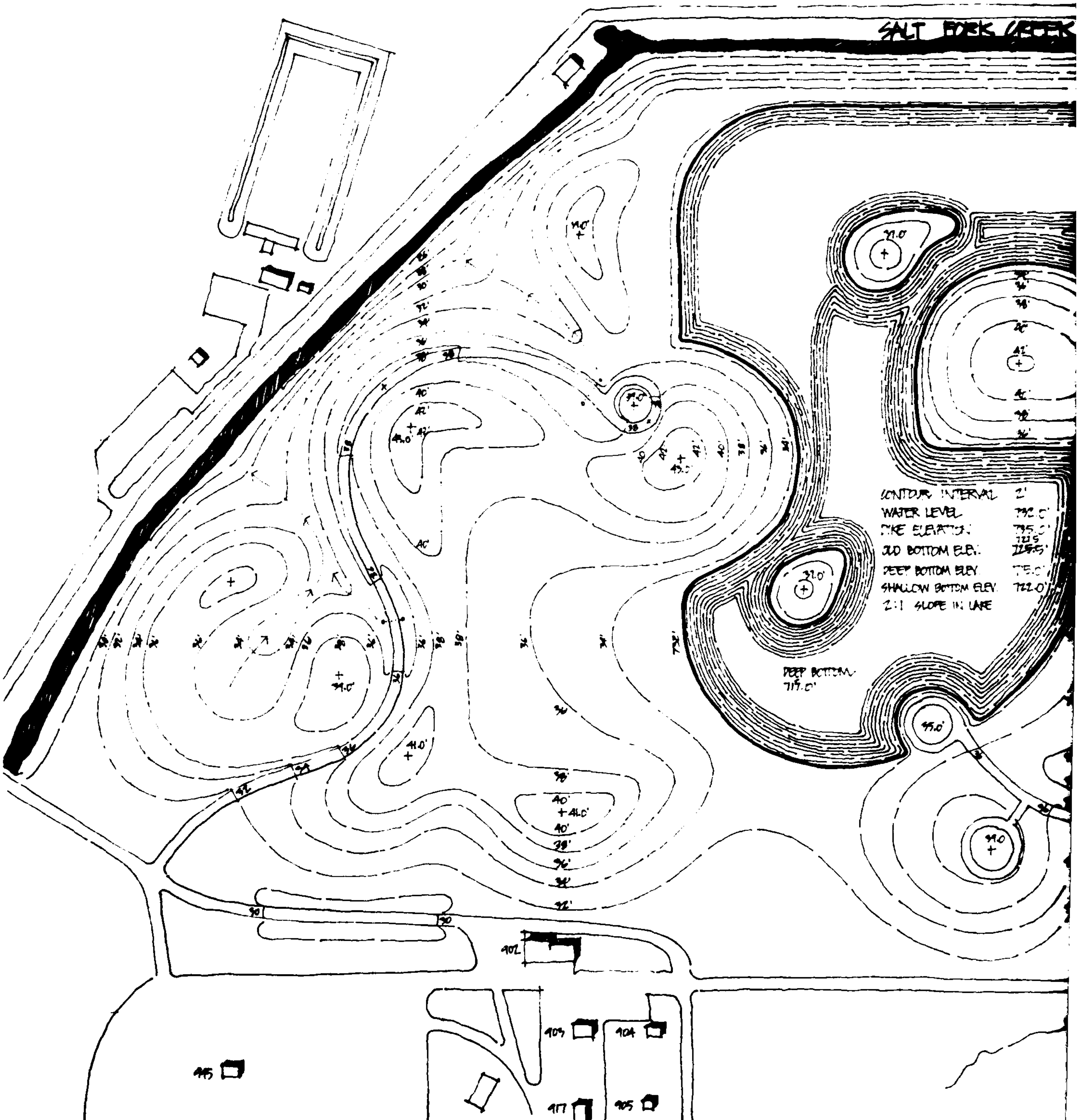
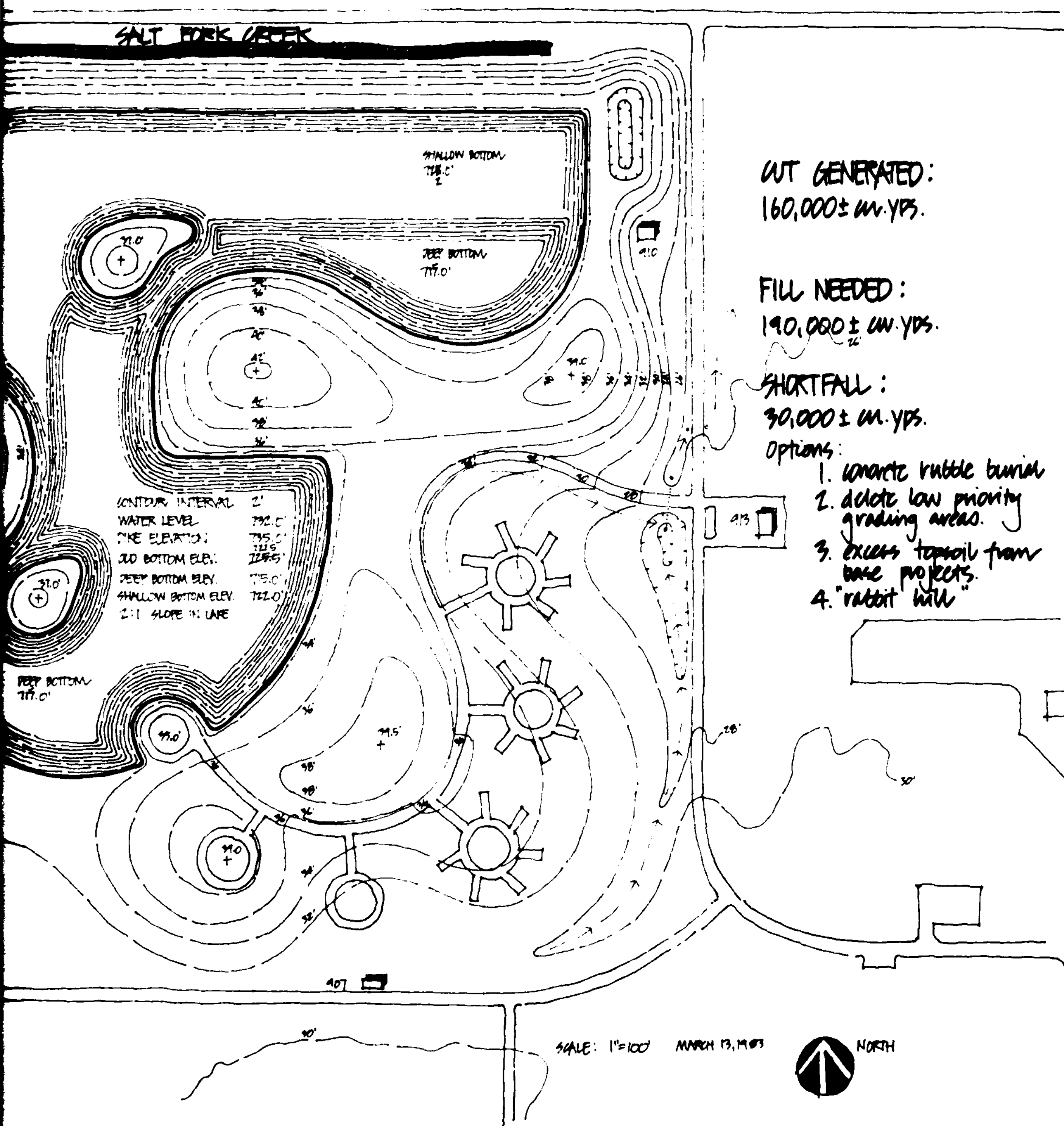



Figure 10. Proposed grading plan.


SALT FORK CREEK
SHALLOW BOTTOM
DEEP BOTTOM
CUT GENERATED:
160,000± CU. YDS.
FILL NEEDED:
190,000± CU. YDS.
SHORTFALL:
30,000± CU. YDS.
Options:
1. concrete rubble burial
2. delete low priority grading areas.
3. excess topsoil from base projects.
4. "rabbit hill"
CONTOUR INTERVAL 2'
WATER LEVEL
DIKE ELEVATION
DEEP BOTTOM ELEV.
SHALLOW BOTTOM ELEV.
2:1 SLOPE IN LAKE
DEEP BOTTOM
SCALE: 1"=100'
NORTH

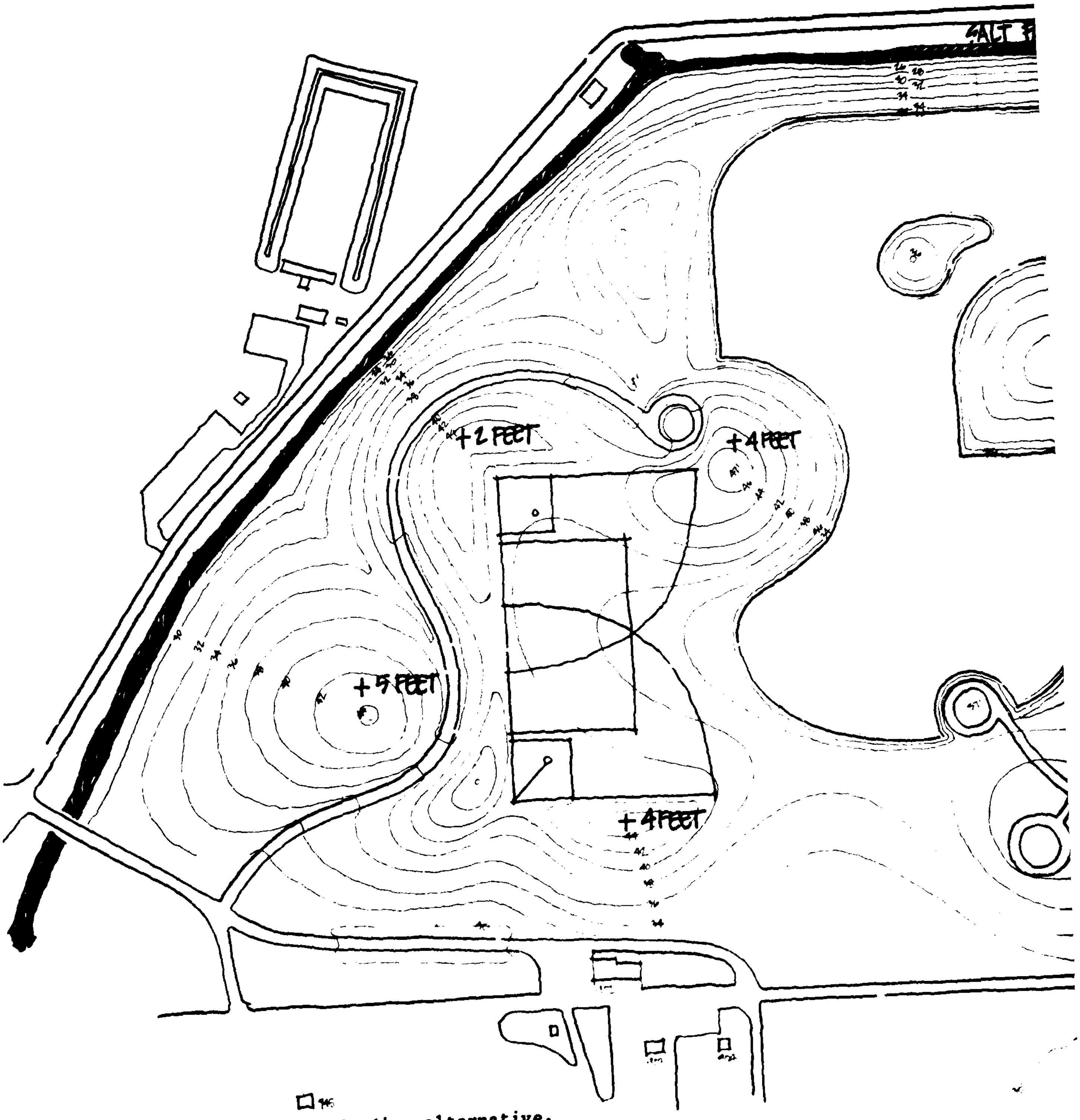
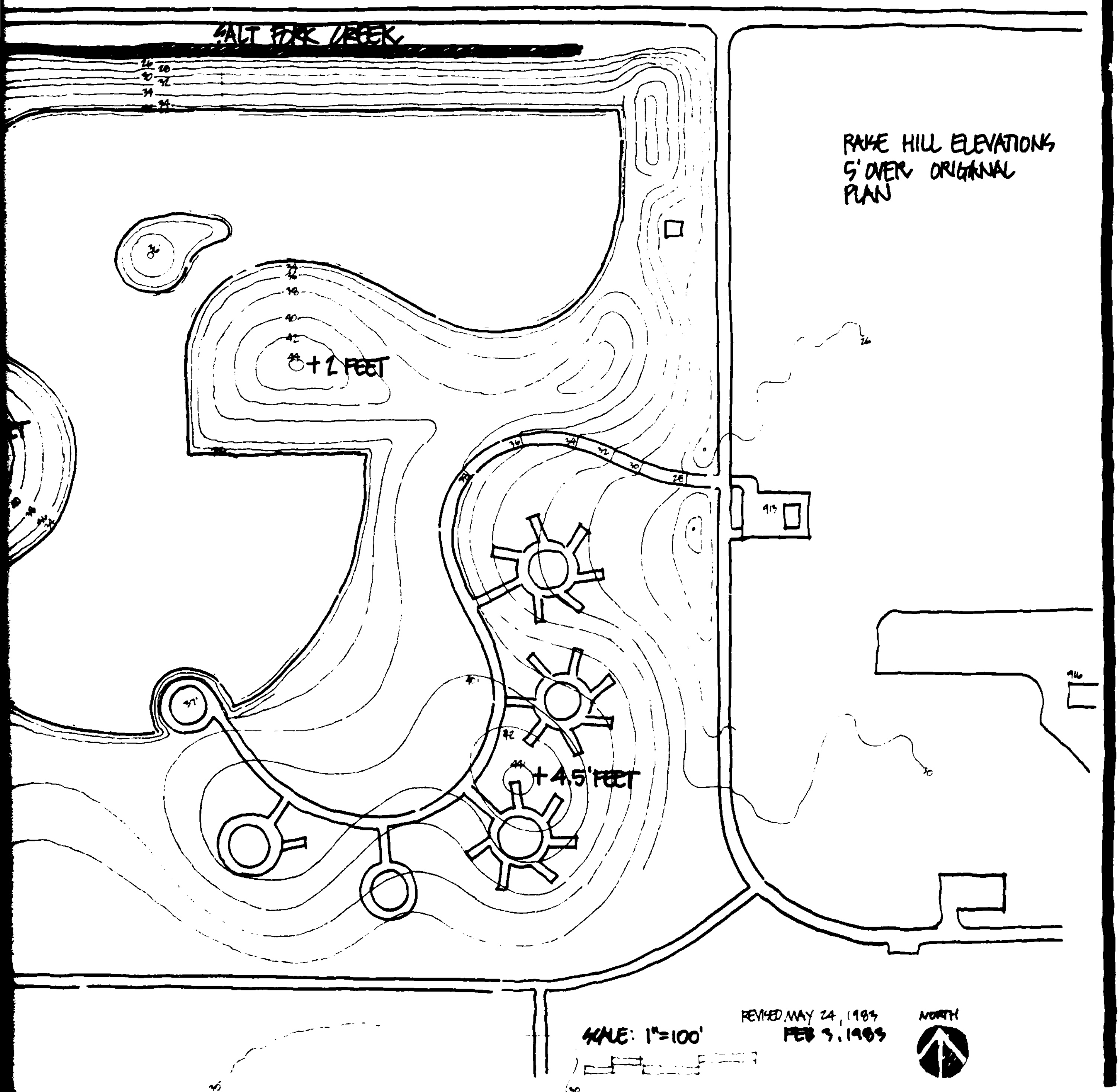



Figure 11. Grading alternative.


SALT FORK CREEK
RAISE HILL ELEVATIONS
5' OVER ORIGINAL
PLAN
+2 FEET
+4.5' FEET
SCALE: 1"=100'
REVISED MAY 24, 1983
FEB 3, 1983
NORTH

2

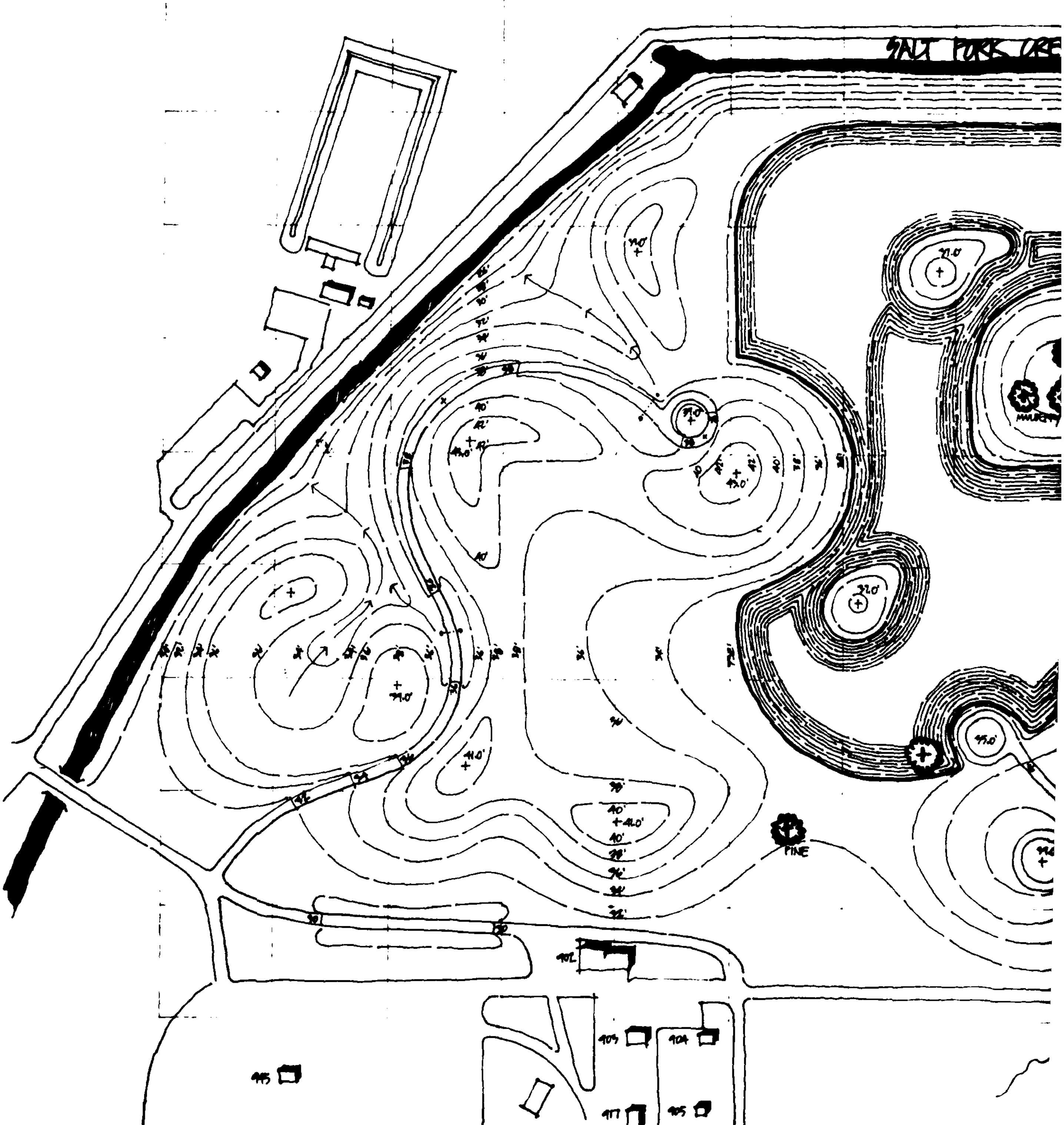
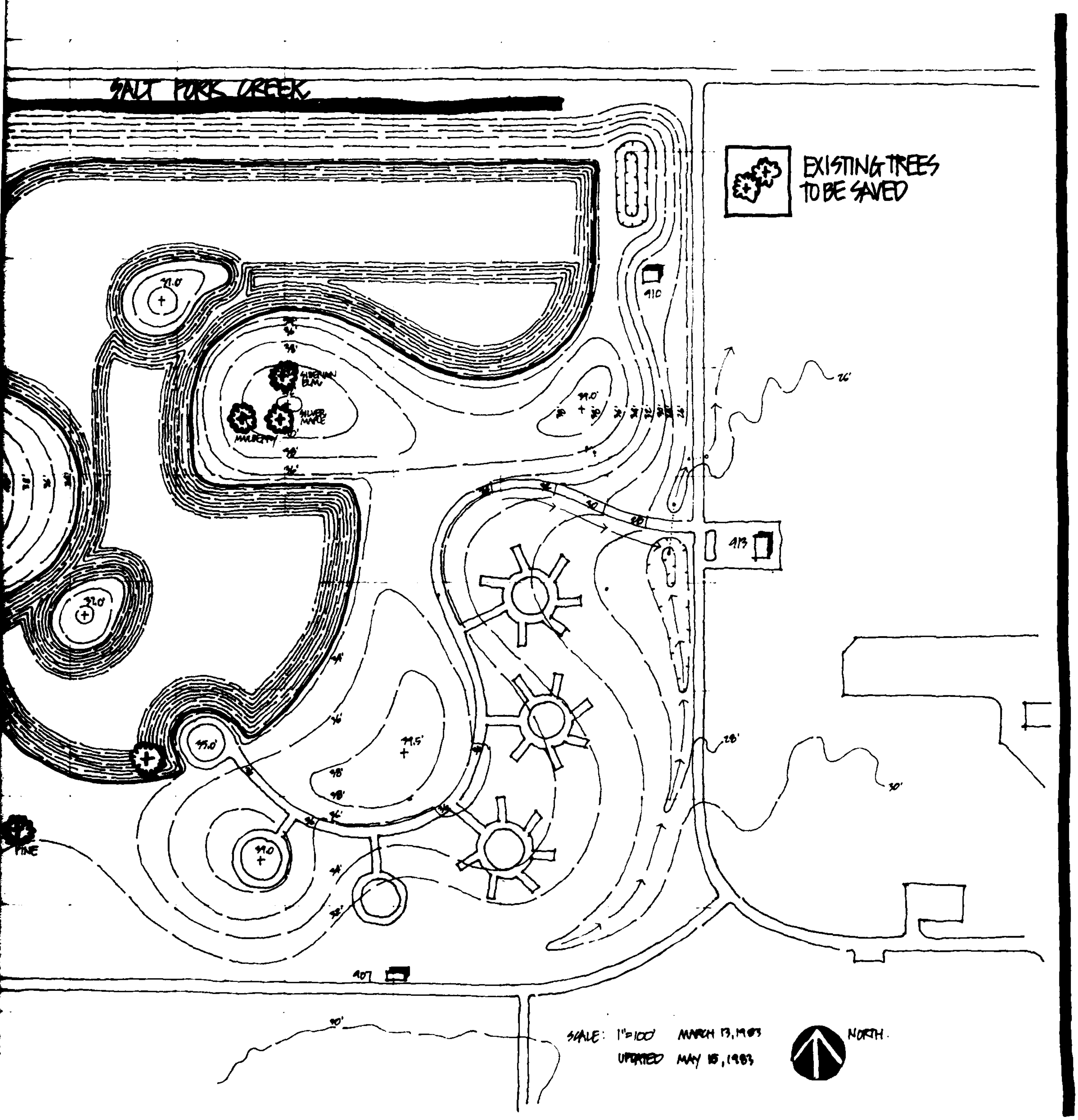



Figure 12. Saving existing trees.



SALT FORK CREEK
EXISTING TREES TO BE SAVED
SIBERIAN ELM
SILVER MAPLE
MULBERRY
PINE
910
913
907
SCALE: 1"=100' MARCH 13, 1983
UPDATED MAY 15, 1983
NORTH


2

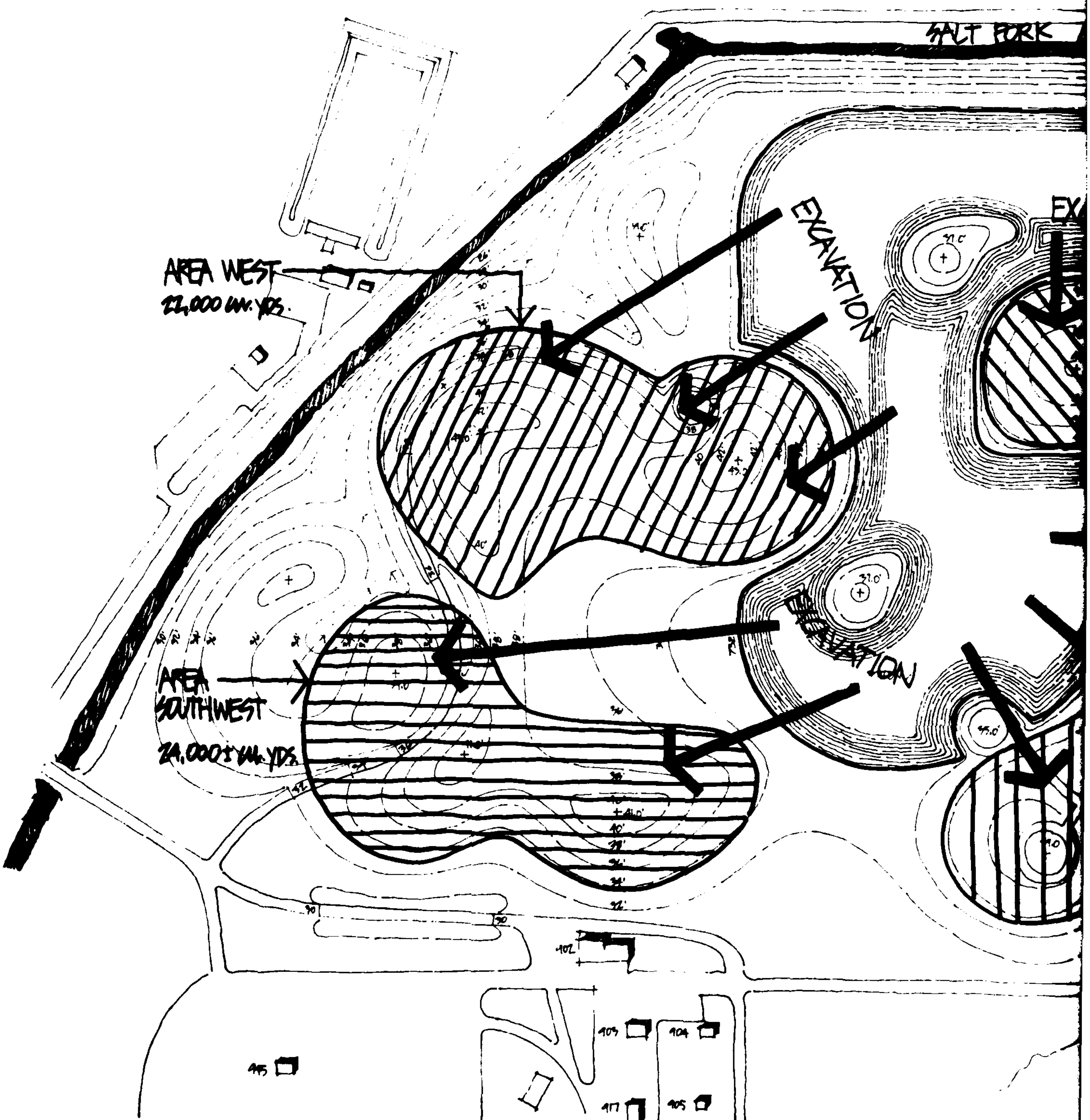
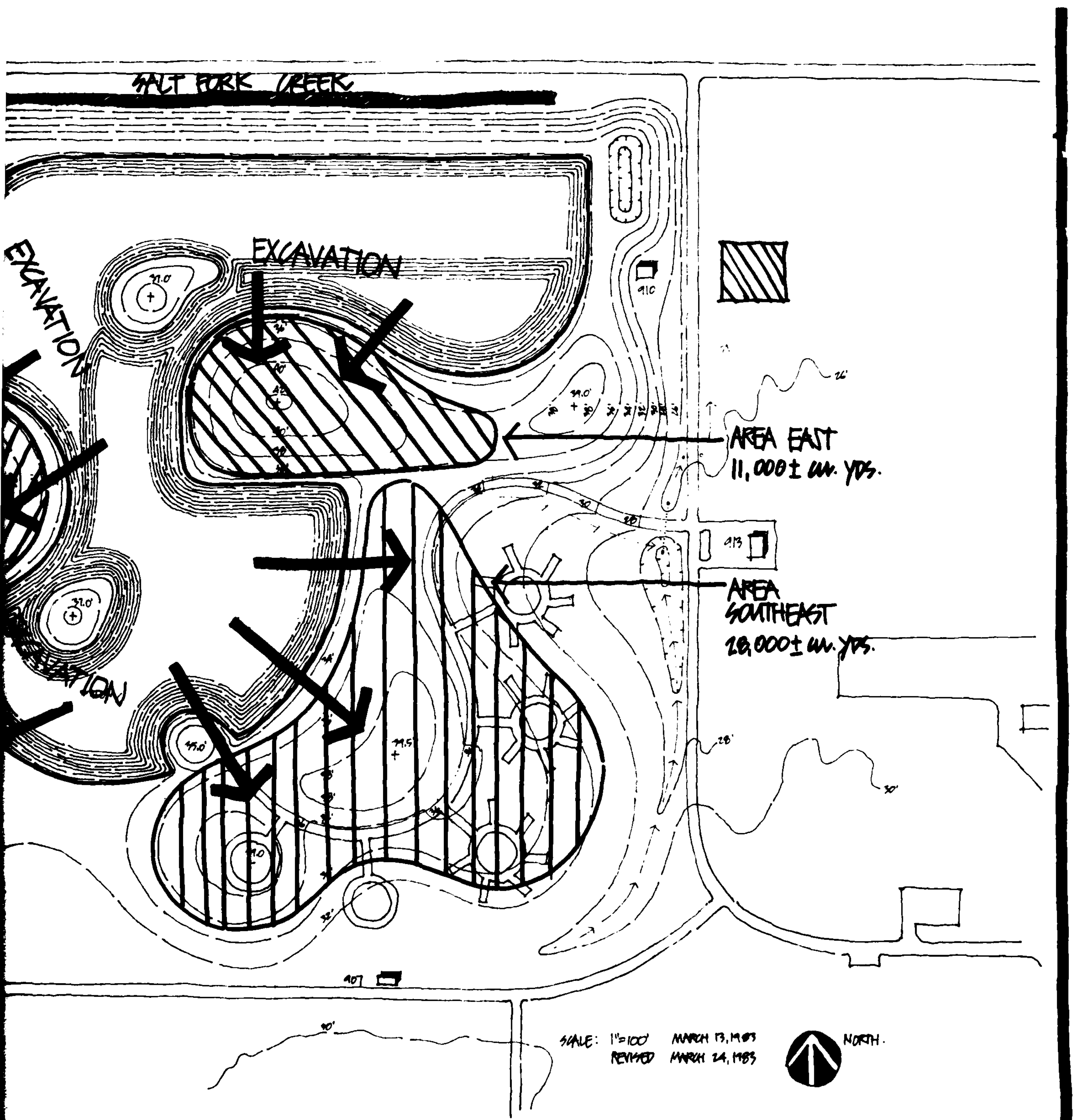



Figure 13. Excavation placement areas.



SALT FORK CREEK
EXCAVATION
EXCAVATION
EXCAVATION
AREA EAST
11,000± CU. YDS.
AREA SOUTHEAST
28,000± CU. YDS.
SCALE: 1"=100' MARCH 13, 1983
REVISED MARCH 24, 1983
NORTH.


2

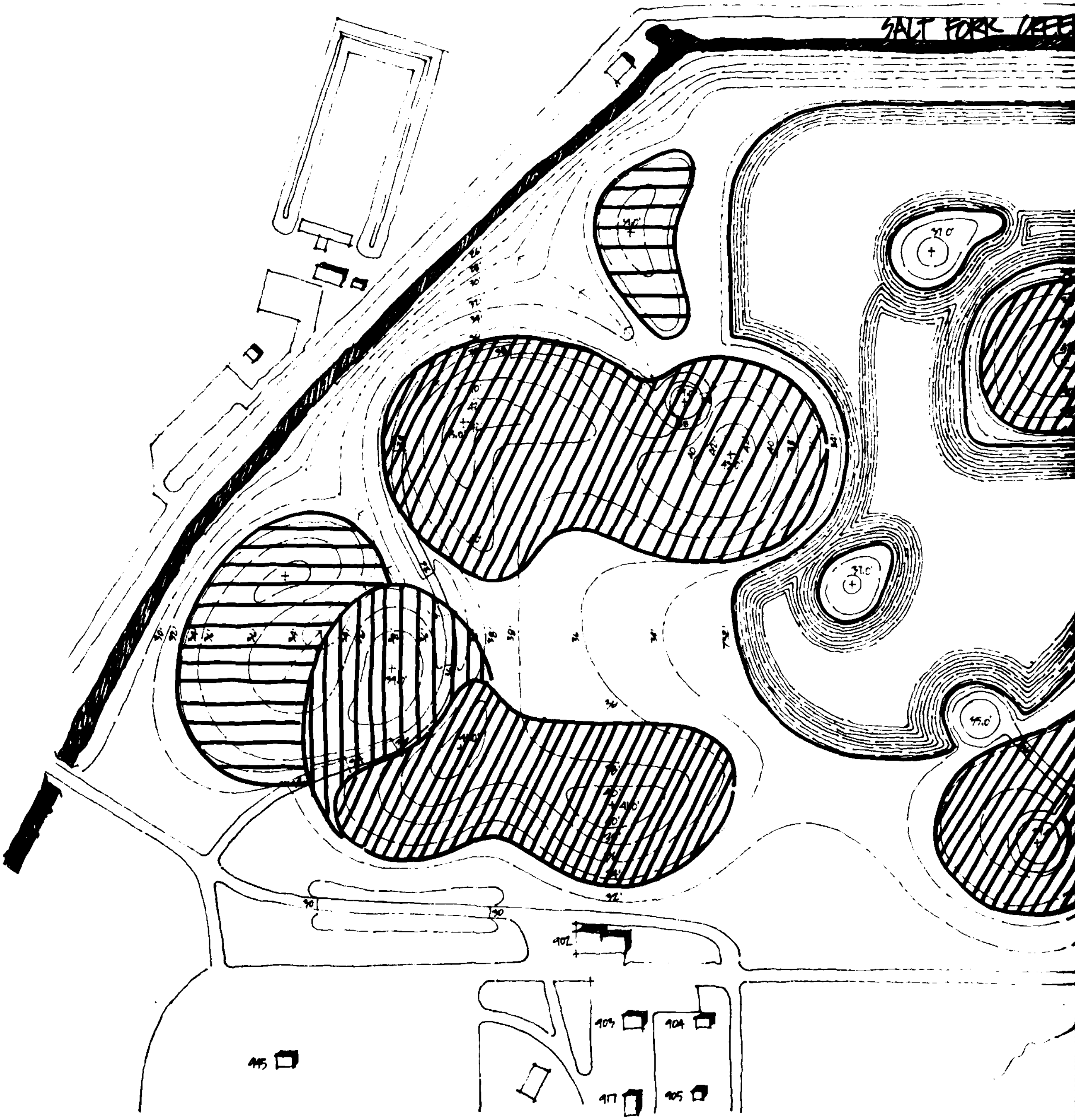
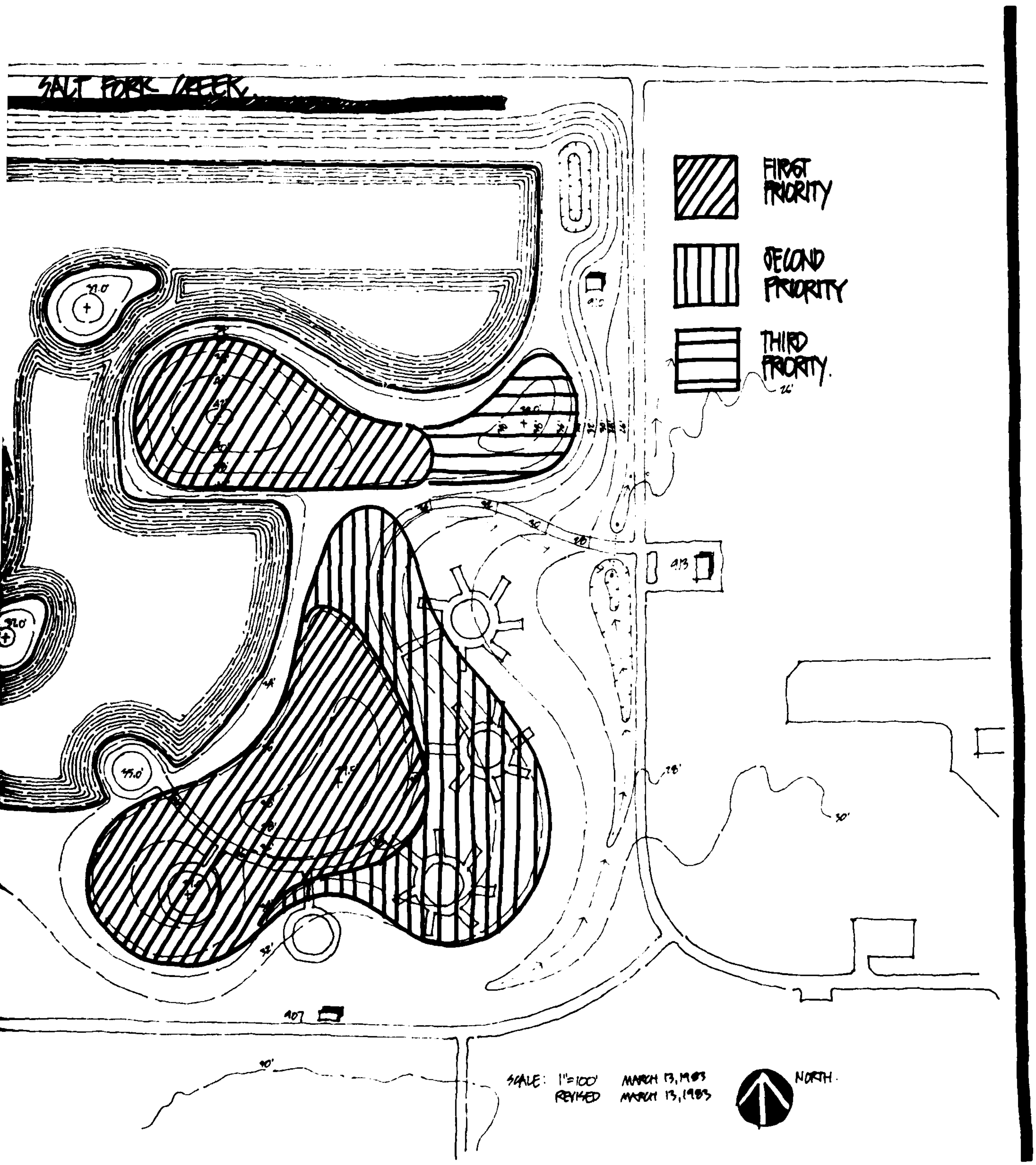



Figure 14. Grading balance options.


SALT FORK CREEK
FIRST PRIORITY
SECOND PRIORITY
THIRD PRIORITY.
SCALE: 1"=100' MARCH 13, 1983
REVISED MARCH 13, 1983
NORTH.

1 2

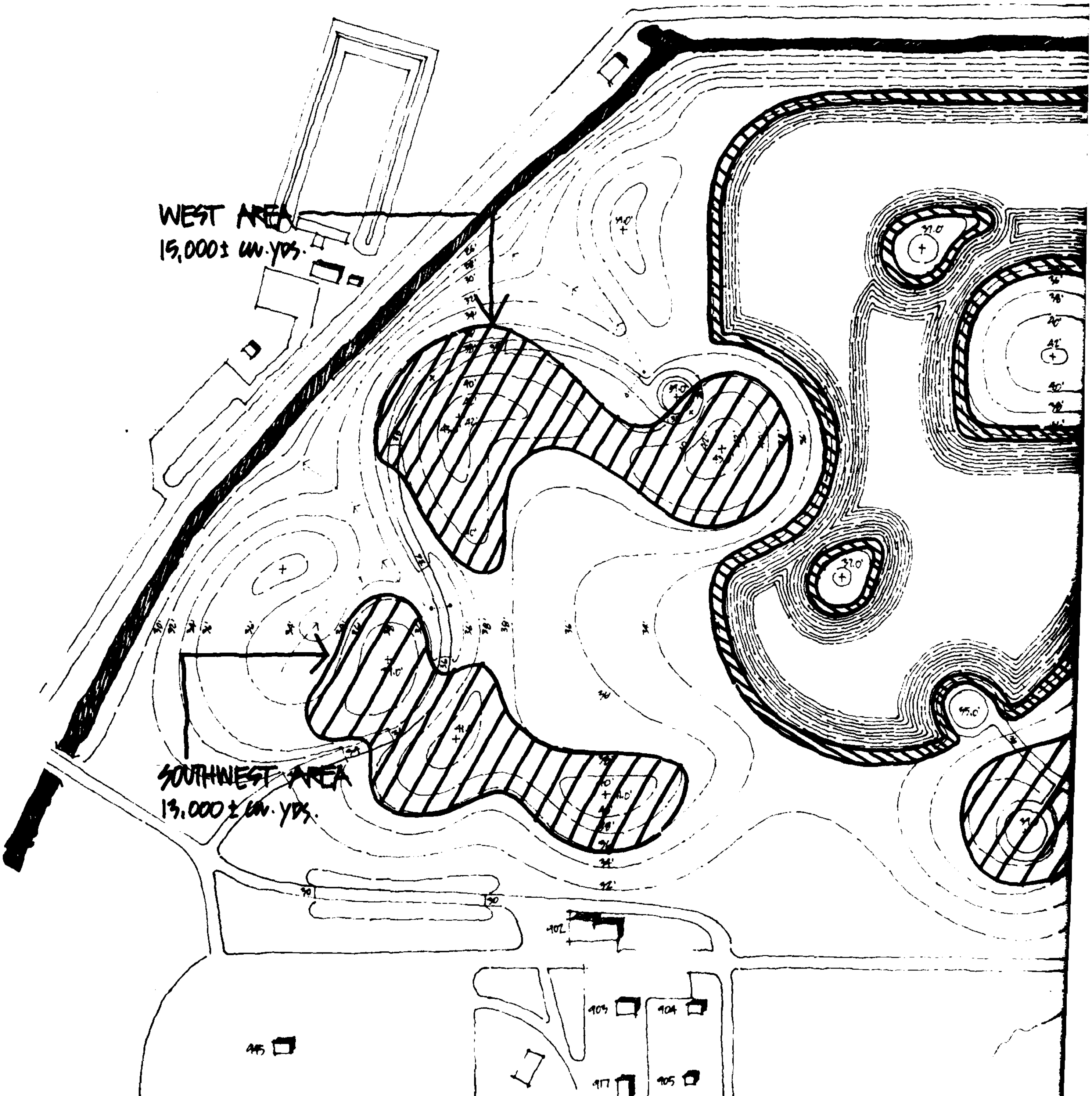
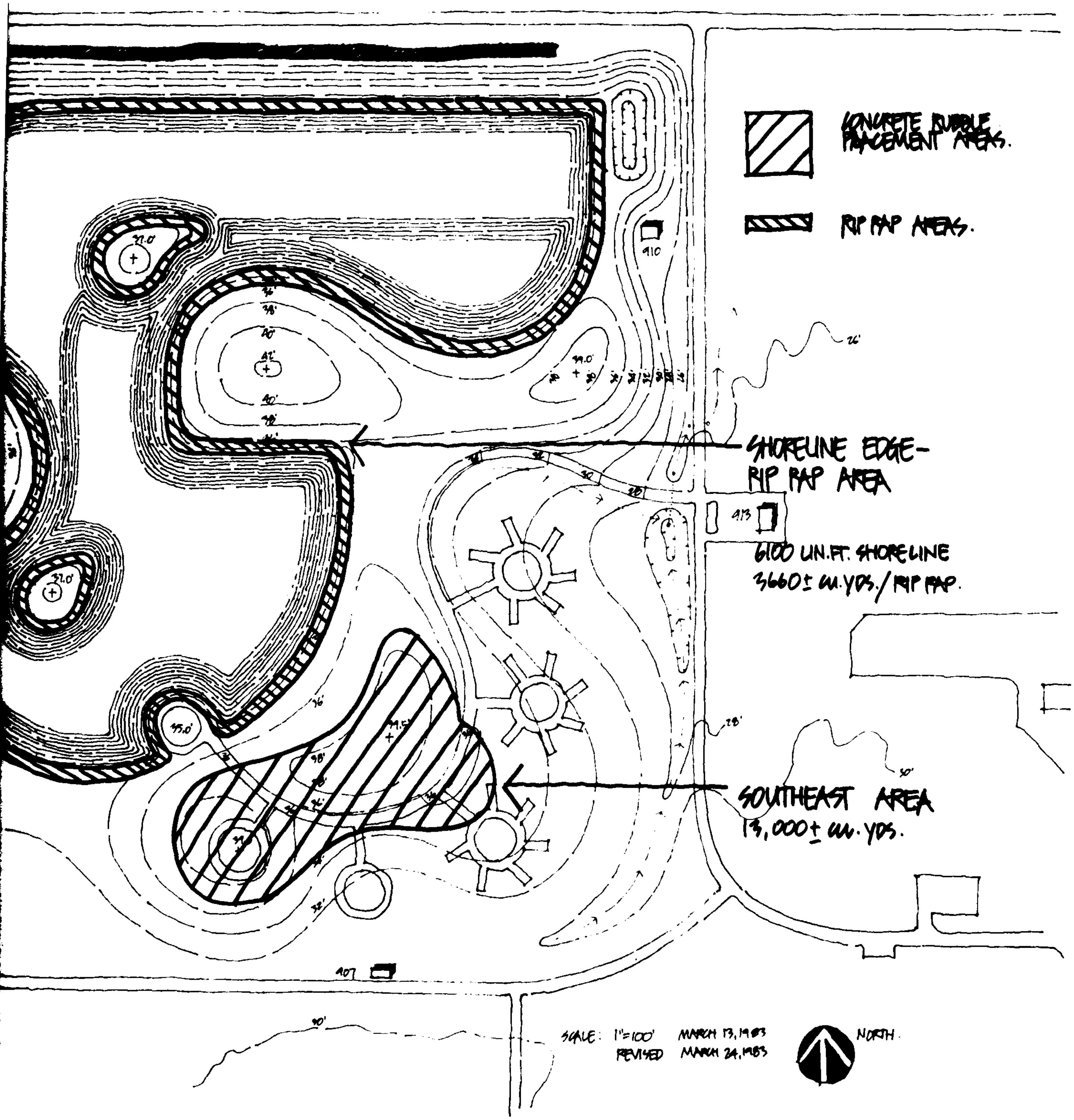



Figure 15. Concrete rubble placement.



CONCRETE RUBBLE PLACEMENT AREAS.
RIP RAP AREAS.
SHORELINE EDGE-
RIP RAP AREA
6100 LIN.FT. SHORELINE
3660± CU.YDS./RIP RAP.
SOUTHEAST AREA
13,000± CU.YDS.
SCALE: 1"=100' MARCH 13,1983
REVISED MARCH 24,1983
NORTH

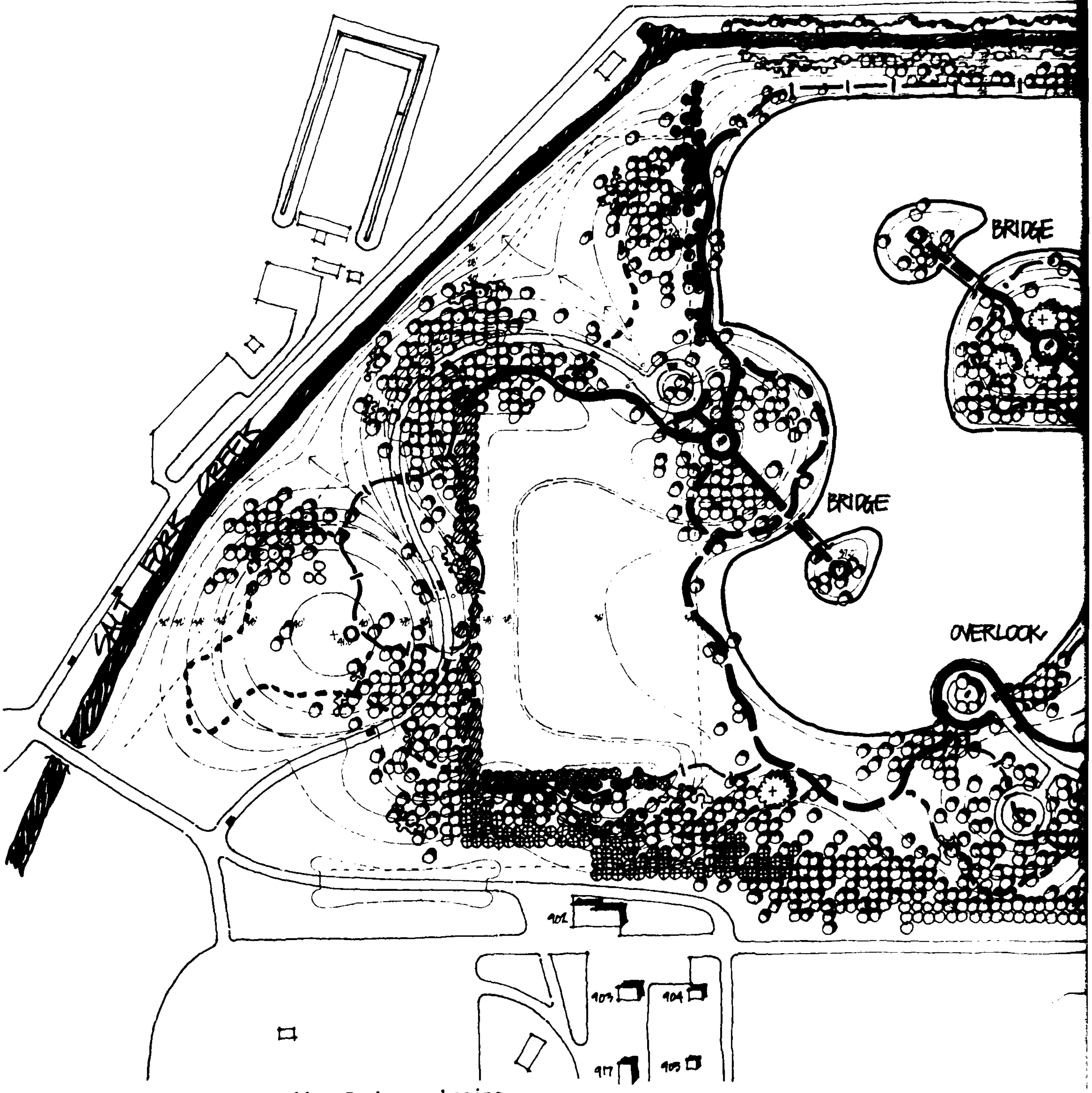
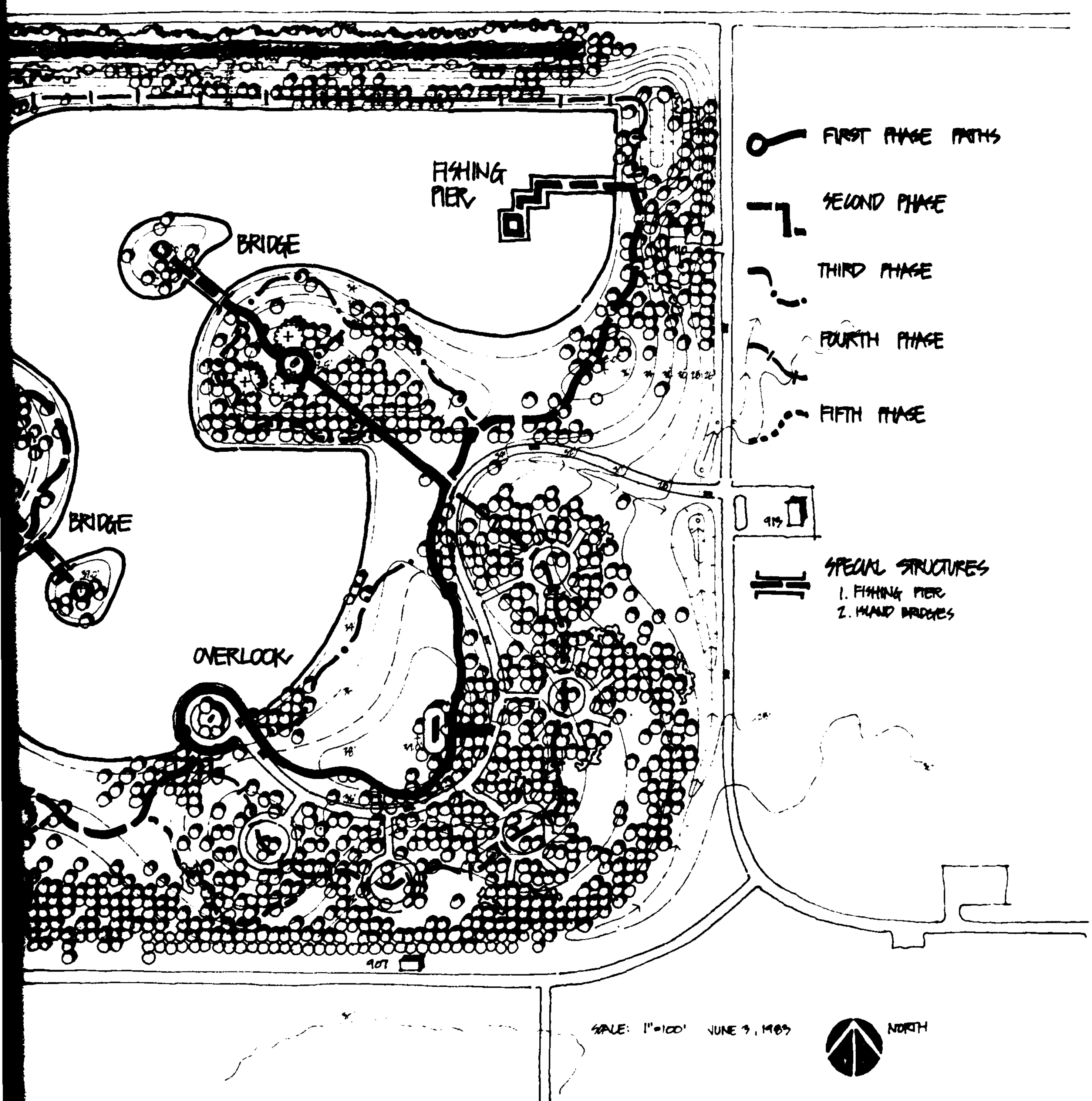



Figure 16. Pathway phasing.


FISHING PIER
BRIDGE
BRIDGE
OVERLOOK
FIRST PHASE PATHS
SECOND PHASE
THIRD PHASE
FOURTH PHASE
FIFTH PHASE
SPECIAL STRUCTURES
1. FISHING PIER
2. ISLAND BRIDGES
907
SCALE: 1"=100' JUNE 3, 1983
NORTH

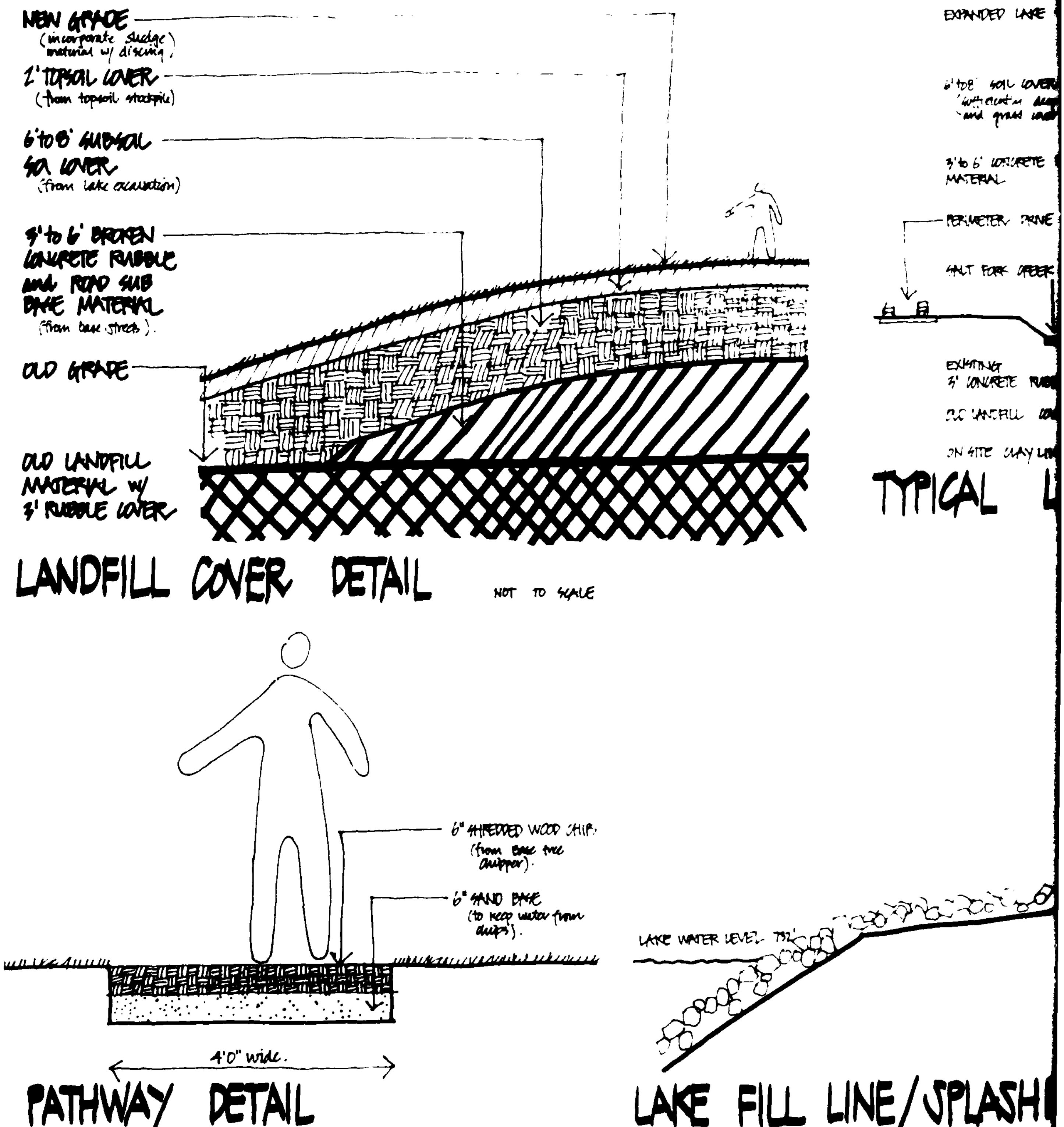
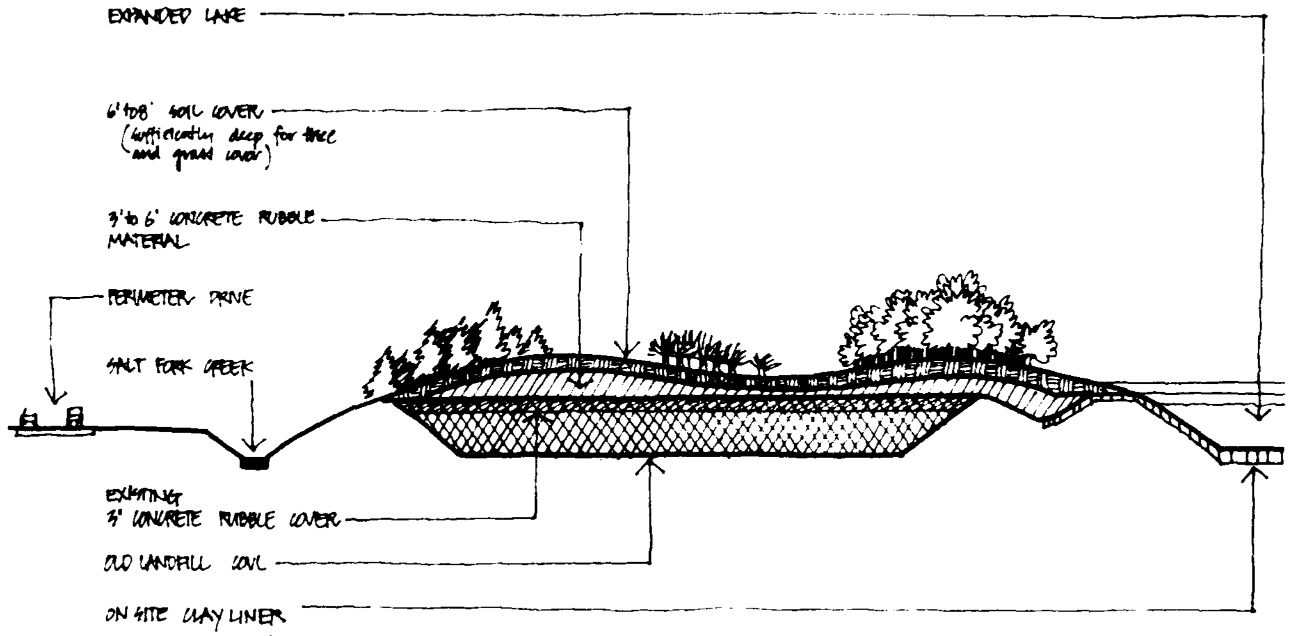
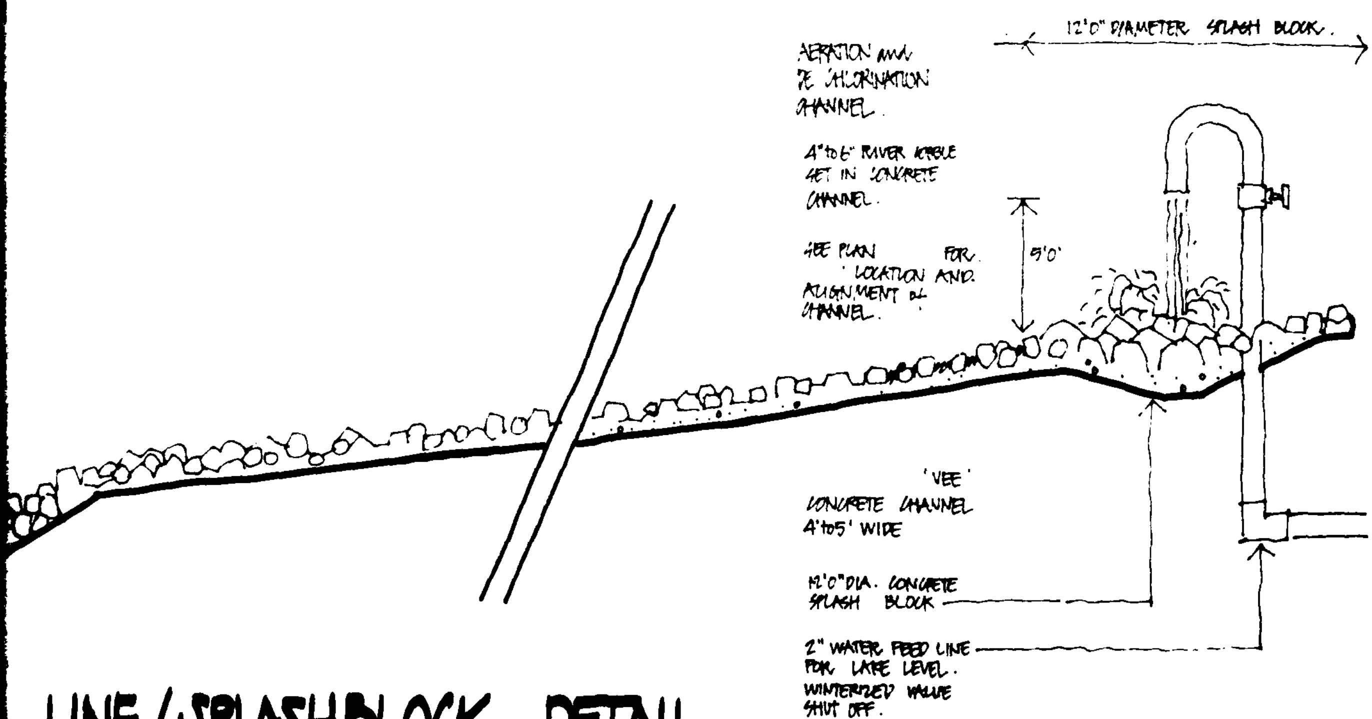



Figure 17. Ground cover detail.




# TYPICAL LANDFILL COVER SECTION

NOT TO SCALE




# LINE/SPLASHBLOCK DETAIL

NOT TO SCALE

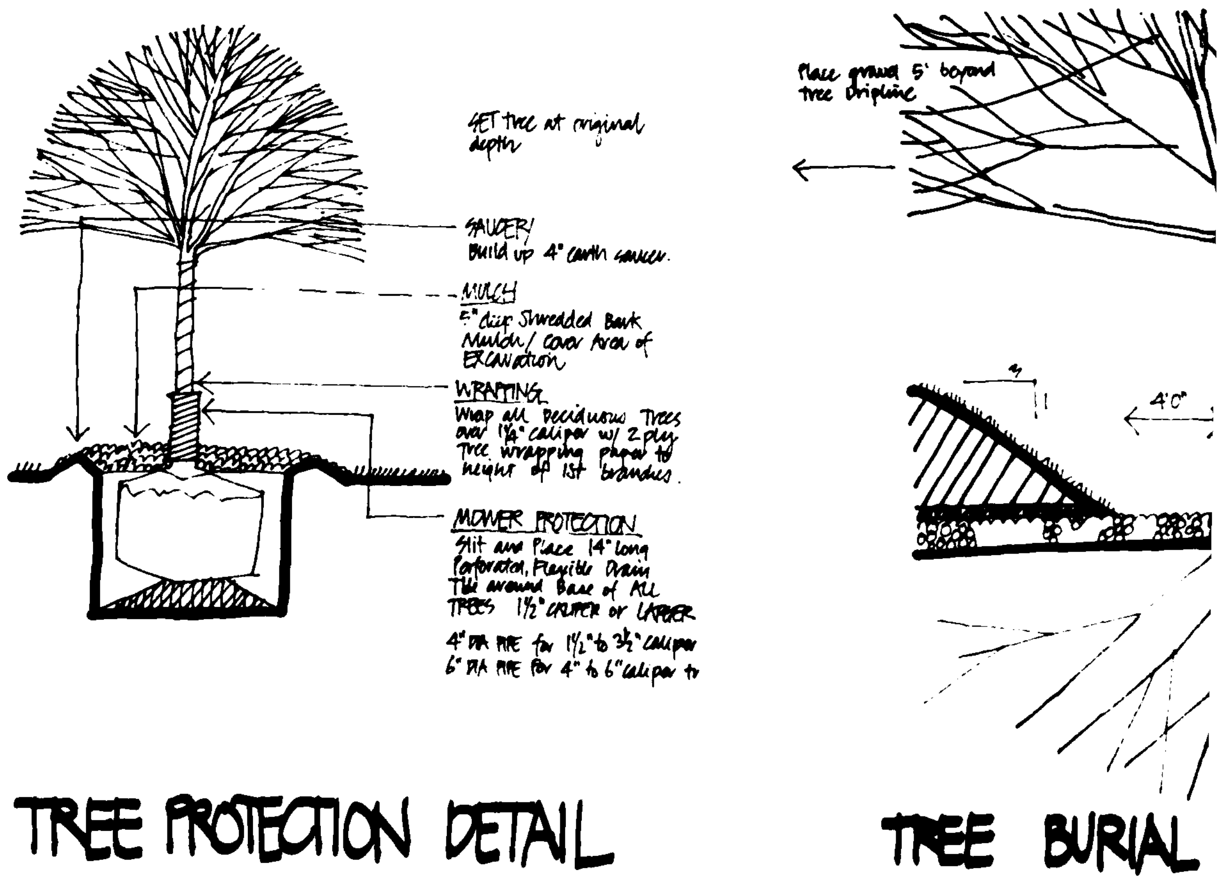
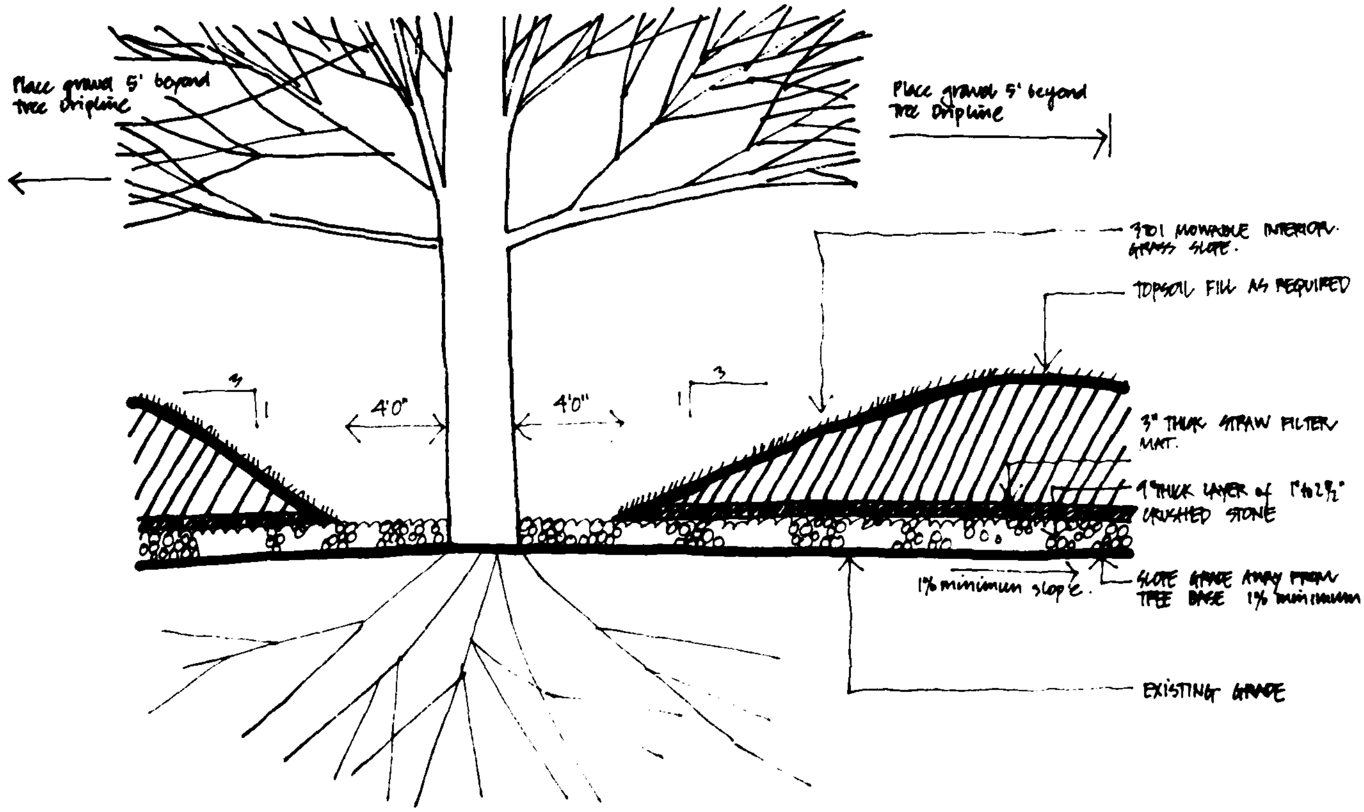



Figure 18. Details for tree protection and tree burial.




# TREE BURIAL DETAIL

## 6 PLANTING DESIGN CONCEPT

The purpose of the planting design is to transform the flat farmland, the landfill sites, and the sewage treatment lagoons into a distinctly pleasant, recreational setting within Chanute Air Force Base. This will entail the creation of new topography, re-creation of water (lake project), and development of a planted landscape. This area will be carefully screened from adjacent training facilities while providing views into the distant rural landscape, across to the main base, or to the golf course. Plant life should be dense and strong enough visually so that persons using the lake and grounds might imagine themselves far removed from the Air Base, perhaps as in a forest preserve.

For the planting design strategy, objectives are: high use intensity; low cost; low maintenance; self-help installation; immediate use -- fishing, camping, recreation (organized); long-term use -- recreation (unstructured), nature study; and climate control -- shade, shelter.

Some of these objectives clearly conflict with one another. The most serious contradiction is the certainty of intense use and the need for low-cost plant regeneration to develop wind buffers, visual screens, and woods for future enjoyment. Accomplishing low-cost, long-term planting will require effective control of heavily used areas (paths, fencing, lawns). The need to plant generous quantities to create a very strongly landscaped scene (woods, meadows with clumps or stands of specimen trees, shade for picnicking, screening for wind protection, blocking undesirable views) is in conflict with the objective to achieve low maintenance costs in the long run. Therefore, strategic placement of plant masses and location of the trees in rows or orchards will be necessary to (1) avoid expensive hand maintenance of the ground layer, and (2) allow equipment under the trees for easy maintenance access. In addition, fencing will promote plant regeneration without interruption or destruction.

To help determine the best placement strategy, the site should be carefully zoned by <u>use</u> and <u>use intensity</u>. Priority will be assigned to high-intensity use areas for deciding the size of the initial planting (i.e., the higher the use intensity, the larger the plant size).

For low-use (low-intensity) areas, it is important to balance the appropriate planting with the degree of control (fencing) to protect and maintain ground layers (grass, prairie). The planting strategy will roughly correspond to the sequence shown in Table 4, and species will be selected based on well defined maintenance characteristics, as shown in Table 5.

Tables 6 and 7 show how the various planting strategies and maintenance classes will be correlated in the recreation lake plans. The key purpose is to provide immediate use by personnel while ensuring the plant's long-term success at a reasonable installation cost and appropriate maintenance costs. Additionally, the tables show that no matter what stage the tree cover is in, the appropriate ground cover or tree management action is recommended (e.g., thinning overcrowded trees in zones of lining out tree stock, overseeding with a shade grass mix under heavy tree canopies). Final planting plans will be designed for year-by-year implementation. Every year, the past year's plans

Table 4

Planting Strategy for Low-Intensity Use Areas

| | Nursery Stock | Mown Grass | Lining Out Stock | Prairie Grass | Regeneration |
|---|---|---|---|---|---|
| Immediate cover | 0 | 0 | | | |
| Immediate use | 0 | 0 | | | |
| Intense use | 0 | 0 | | | |
| Low use | | | 0 | 0 | 0 |
| Future use | | | 0 | | |
| Low cost/ | | | | | |
| installation | | 0 | | 0 | |
| maintenance | | | 0 | 0 | 0 |
| Controlled/or fenced areas | | | | | |

Table 5

Maintenance Classes for Plants

| Lawn Class | Requirements | Additional Landscaping |
|---|---|---|
| I (high) | Weekly mowing | Trees scattered<br>Tree clusters<br>Open lawns/playfields |
| II (mod.) | Monthly mowing | Dense woods understory |
| III (low) | No mowing (except brush along paths), annual burning | Abstracted prairie fenced off/regenerating plants (may need occasional pruning) |

Table 6

High-Intensity Use Areas

| | | |
|---|---|---|
| Pathways | | |
| | Asphalt | |
| | Gravel | |
| | Mulch/over sand | Replenish mulch every other year |
| Grassland | | |
| | Fine | Mow weekly |
| | Rough | Mow weekly (gang mower) |
| Savanna/Parkland | | |
| | Ground Layer | Mow weekly |
| | Canopy | 1. Individual trees<br>2. Clumps with grass underneath, planted in rows, grids, or wide enough to allow mowings<br>3. Clumps with mulch underneath (dense clumps). |
| Woodlands | | |
| Can walk into | Ground layer | Grass lawn/mow weekly<br>Grass shade-out<br>Open up canopy<br>Add understory |
| or under | Canopy | Foresting plots planted in rows, grids, or wide enough to mow around. |

Table 7

Low-Intensity Use Area

| | | | |
|---|---|---|---|
| Grassland | | | |
| | Rough I | Mow monthly | |
| | Rough II | Mow annually | |
| Prairie | | | |
| | Basic mix (abstracted), | Annual mowing/burning | |
| | Grasses<br>Forbs | Introduce additional species, wildflower mix | |
| Woodlands | | | |
| | Ground layer | Grass/no mowing cover shade-out | Eventual grass |
| | Canopy | Lining out stock (4 ft), mixed planting | Thin<br>Create pathways |
| | Canopy | Regeneration/old field succession | Introduce shrub Layer<br>Flowing Trees<br>Specimen groves |
| Buffer/Screens | | | |
| | Ground layer | No mowing under | |
| | Evergreen | Remove volunteer nuisance trees | |

will be updated and the current and following years' plans will be confirmed. These yearly plans are projected over 10 years, with several new plantings, maintenance operations, and control or thinning procedures scheduled each year. The yearly plans will always focus on two major parts of the planting scheme:

1. The ground layer (surface treatment, grass cover maintenance).

2. The tree and canopy cover (planting, removal, or maintenance of trees, lining-out materials, shrubs).

A documented plan designing intent and tasks for each year will provide base personnel with the direction needed to accomplish their recreation area planting work. Figures 19 through 27 show proposed planting strategies for the project. Table 8 is a list of plant species that could be incorporated into the plan.

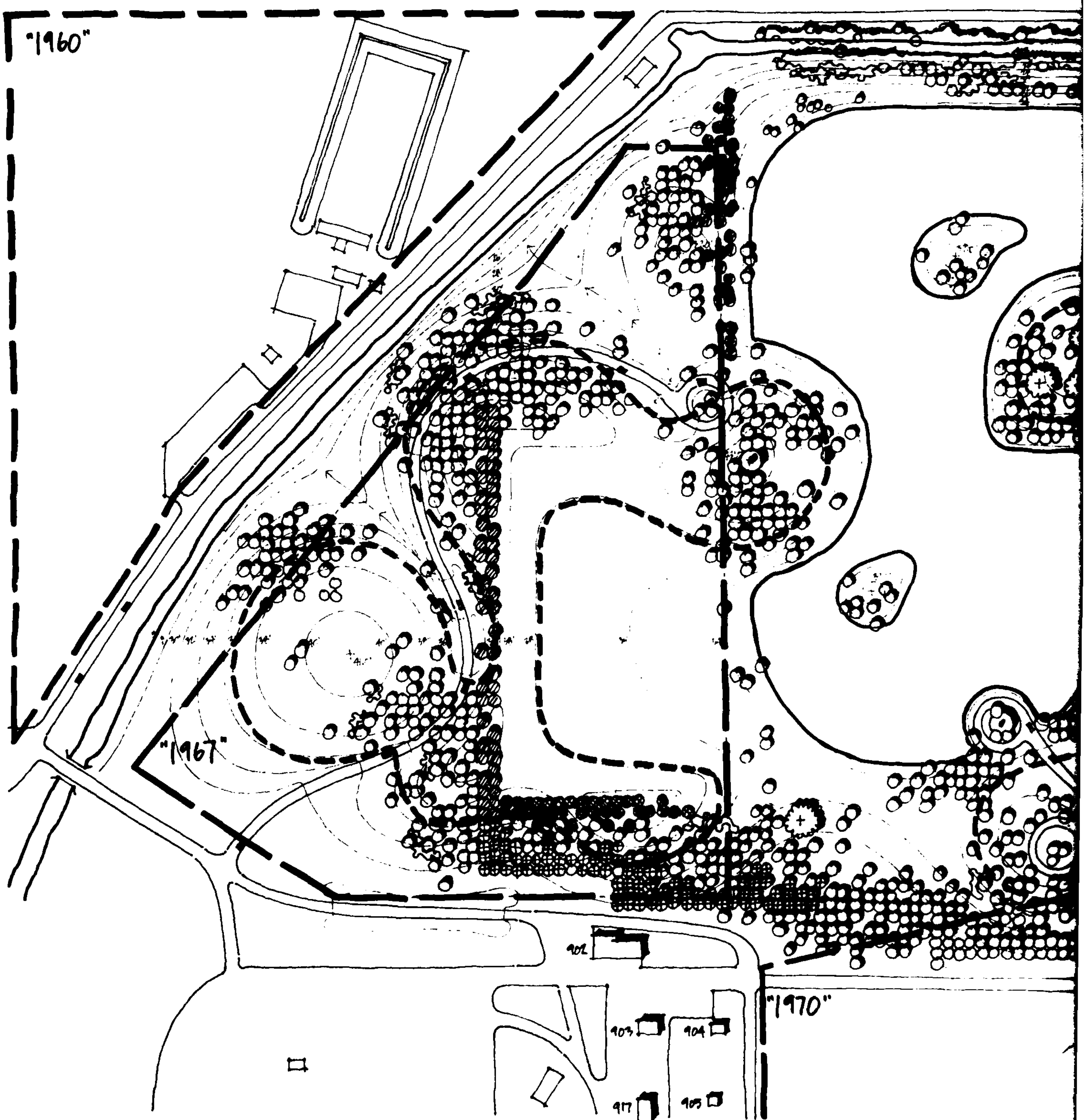
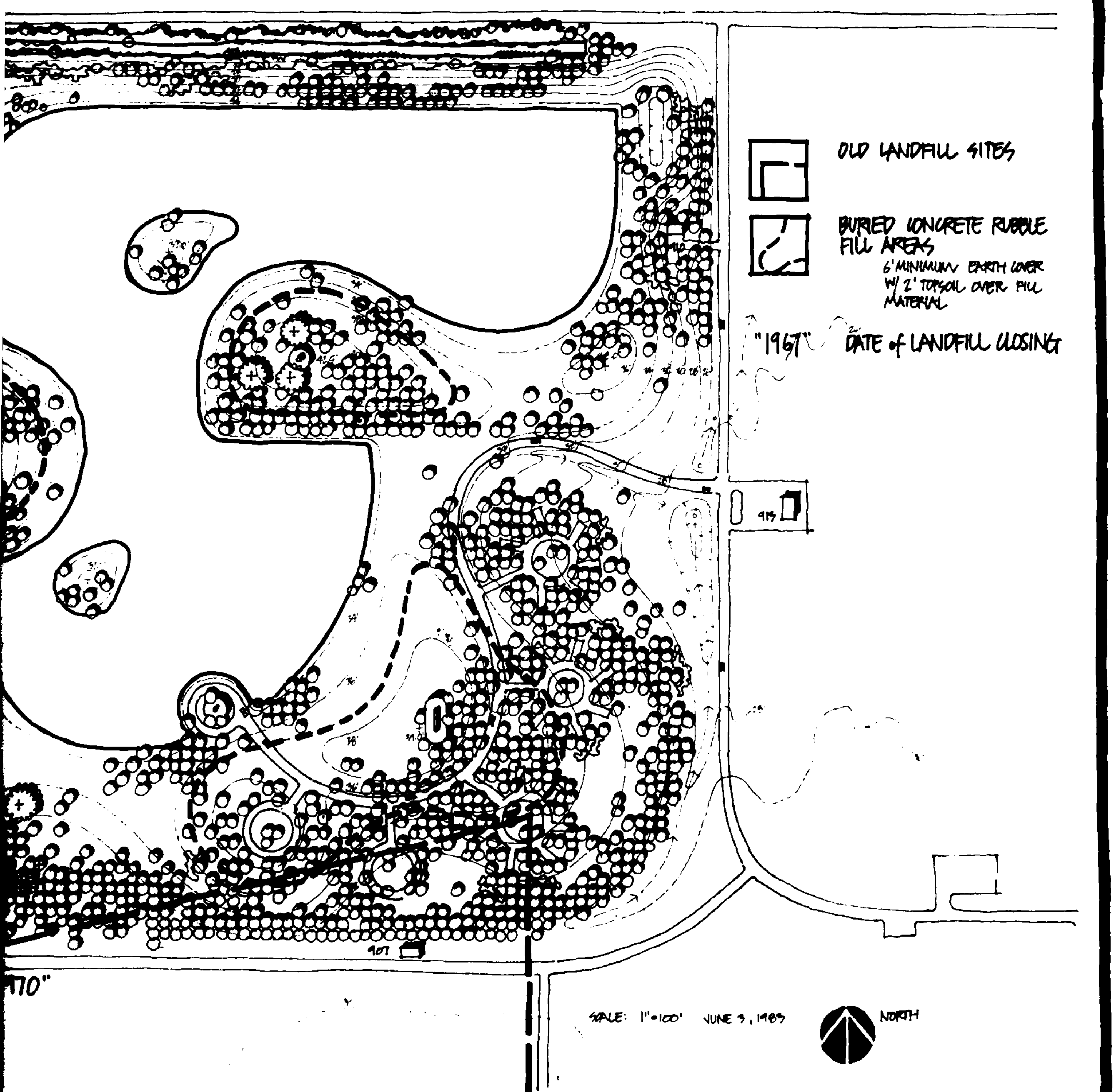



Figure 19. Landfill areas.


OLD LANDFILL SITES
BURIED CONCRETE RUBBLE FILL AREAS
6' MINIMUM EARTH COVER W/ 2' TOPSOIL OVER FILL MATERIAL
"1967" DATE of LANDFILL CLOSING
907
913
"1970"
SCALE: 1"=100' JUNE 3, 1983
NORTH

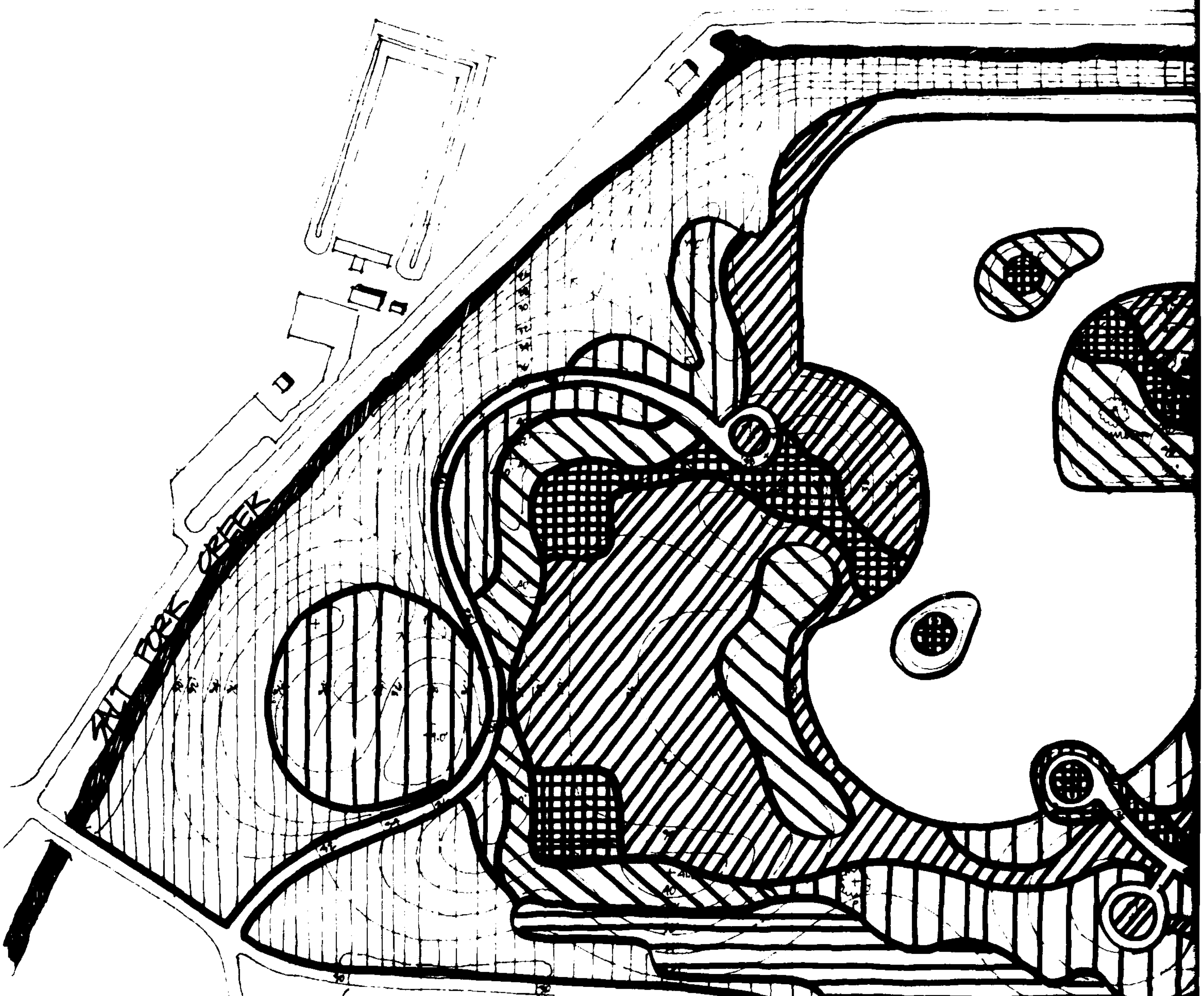
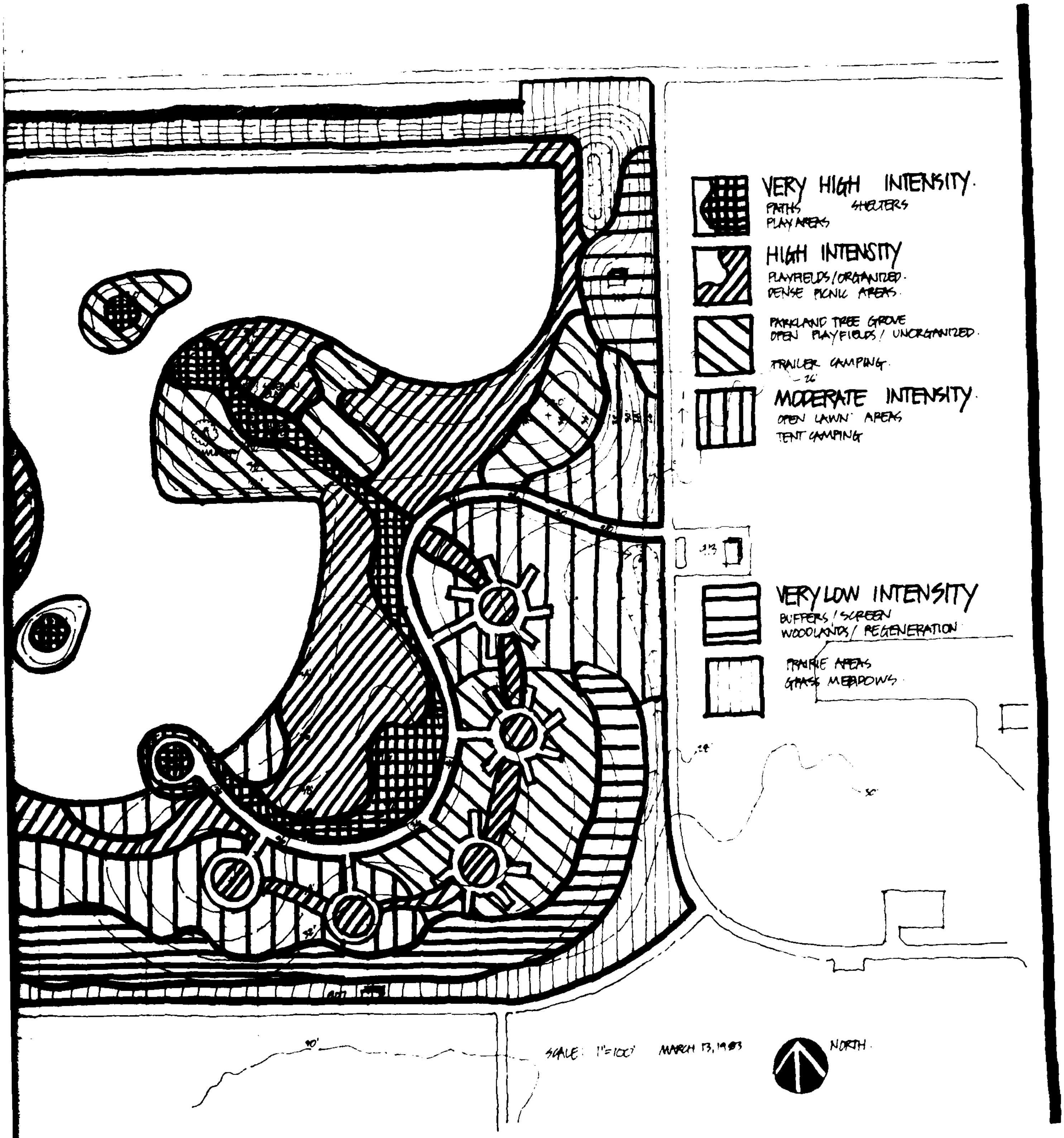


Figure 20. Use intensity zones.


VERY HIGH INTENSITY.
PATHS SHELTERS
PLAY AREAS
HIGH INTENSITY
PLAYFIELDS/ORGANIZED.
DENSE PICNIC AREAS.
PARKLAND TREE GROVE
OPEN PLAYFIELDS/ UNORGANIZED.
TRAILER CAMPING.
MODERATE INTENSITY.
OPEN LAWN AREAS
TENT CAMPING
VERY LOW INTENSITY
BUFFERS/SCREEN
WOODLANDS/ REGENERATION
PRAIRIE AREAS
GRASS MEADOWS.
SCALE: 1"=100'
MARCH 13, 1983
NORTH.

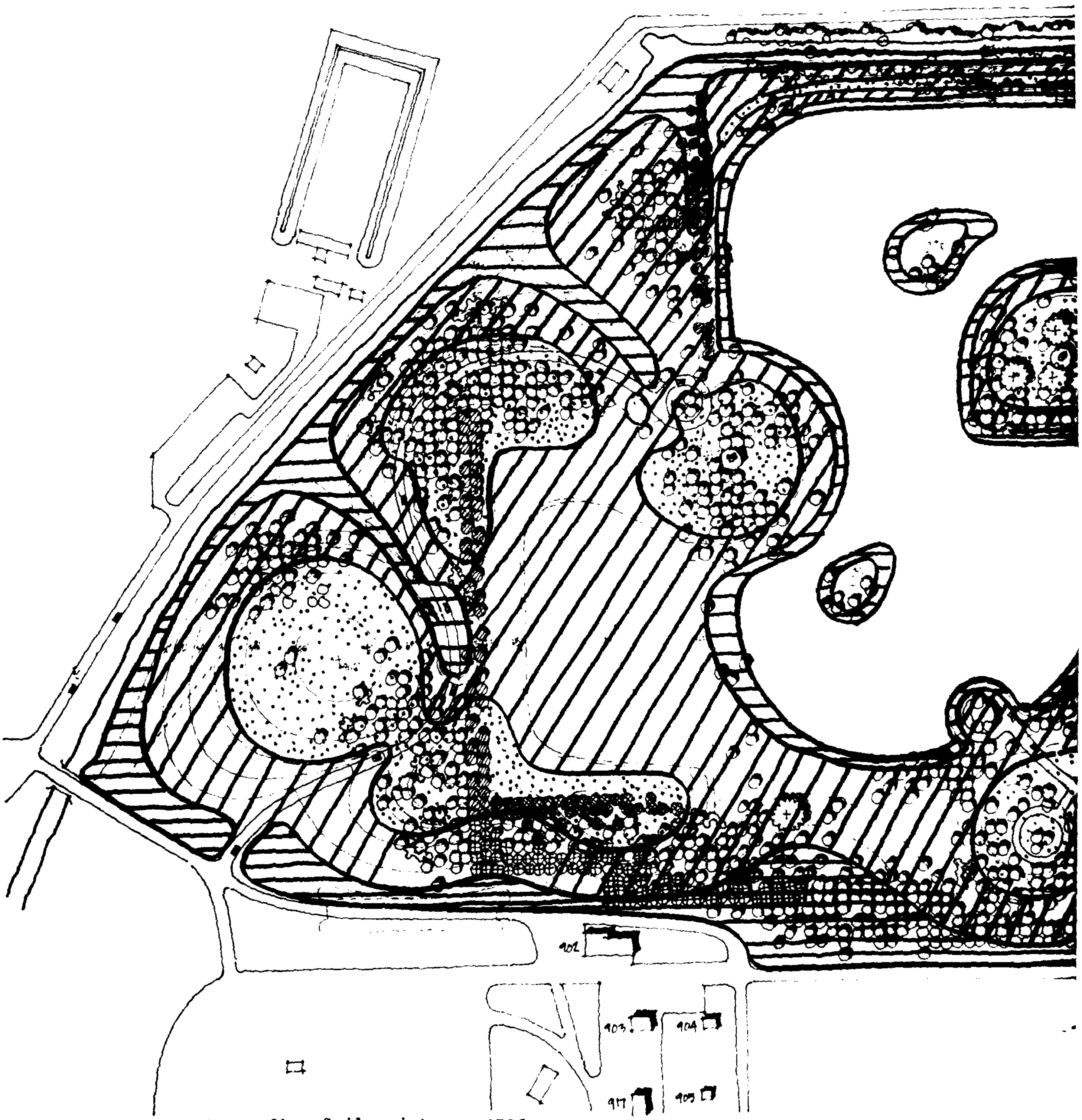
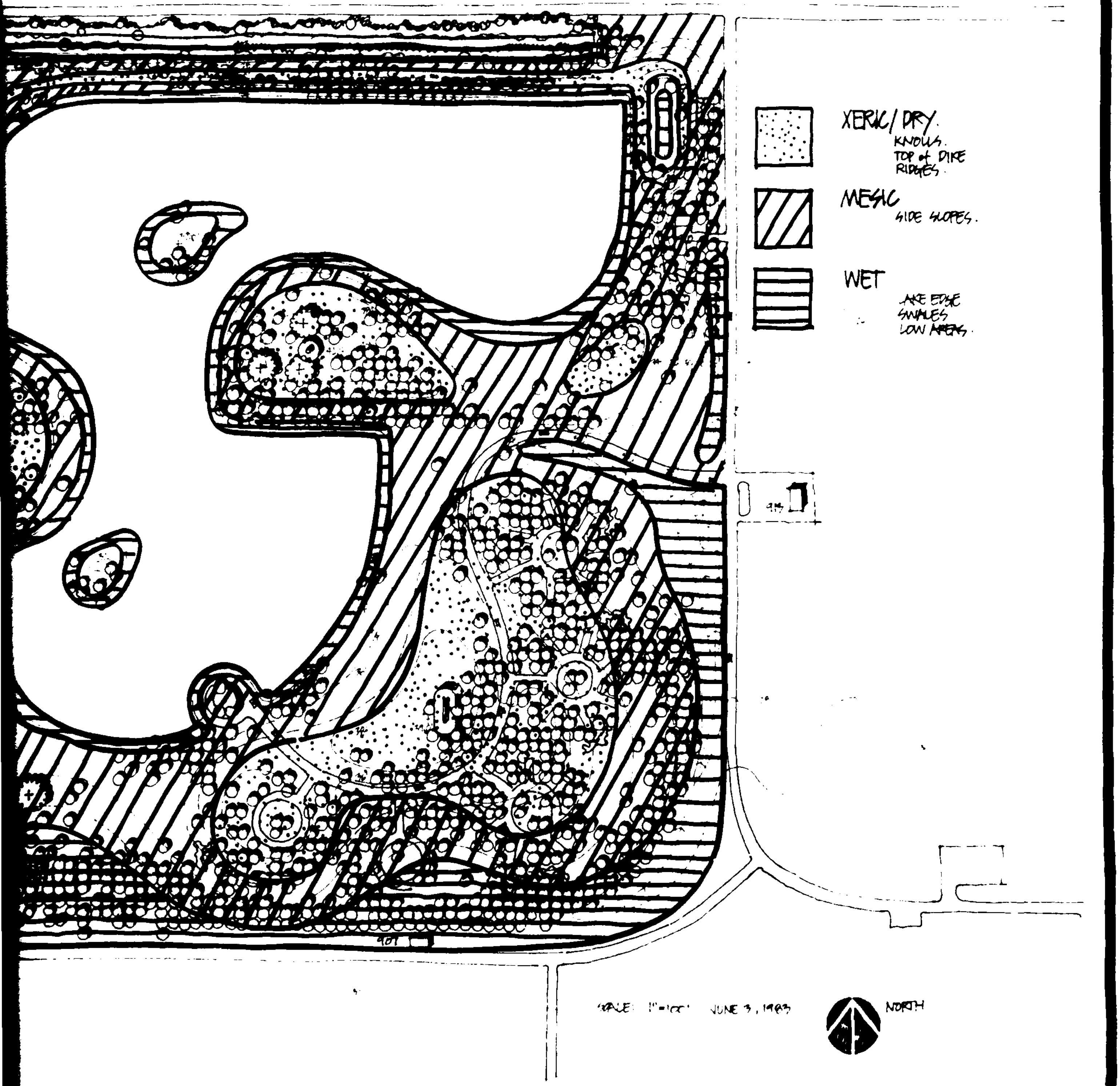



Figure 21. Soil moisture zones.


XERIC/DRY
KNOLLS
TOP of DIKE
RIDGES
MESIC
SIDE SLOPES
WET
SWALES
LOW AREAS
JUNE 3, 1983
NORTH

2

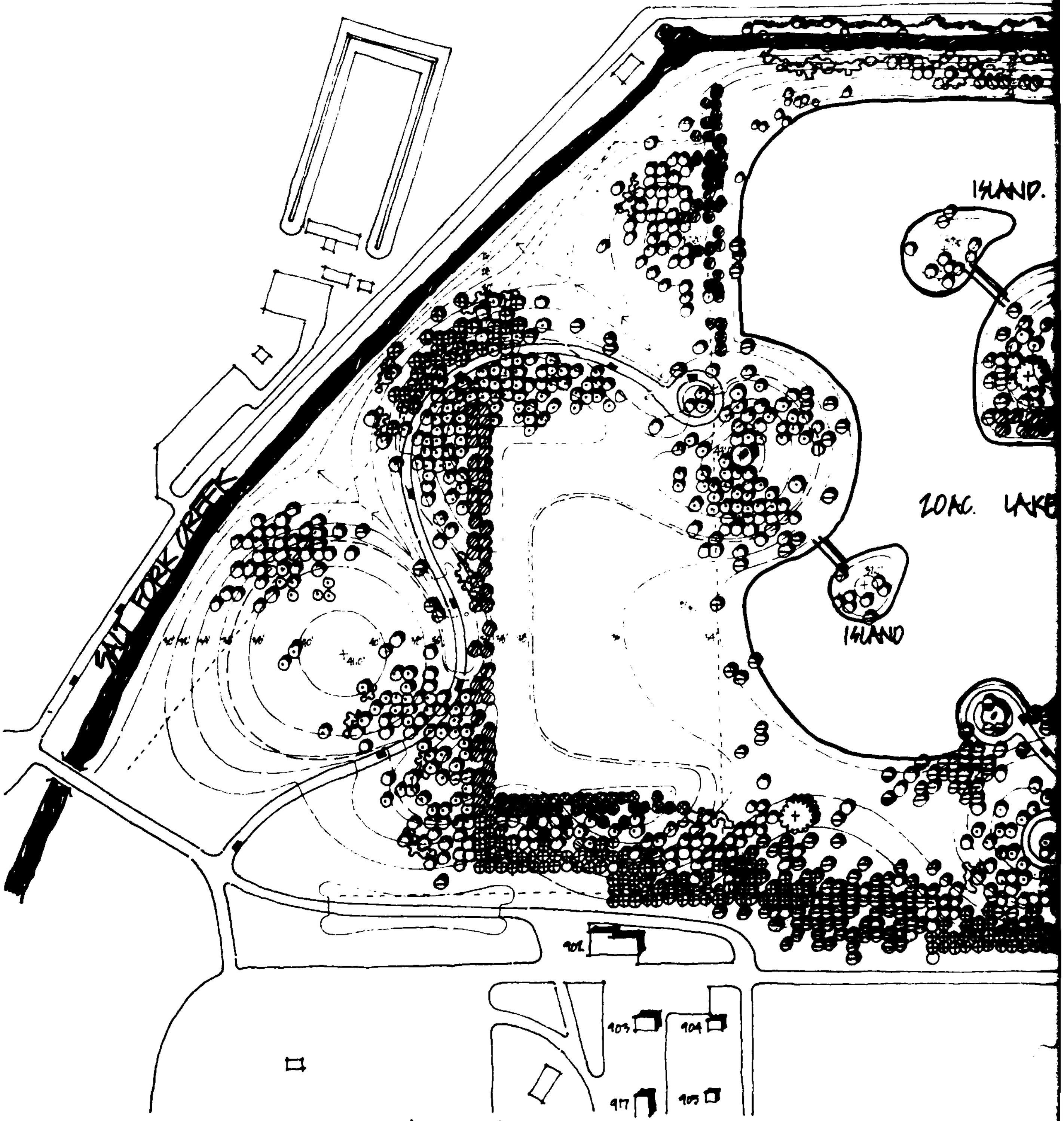
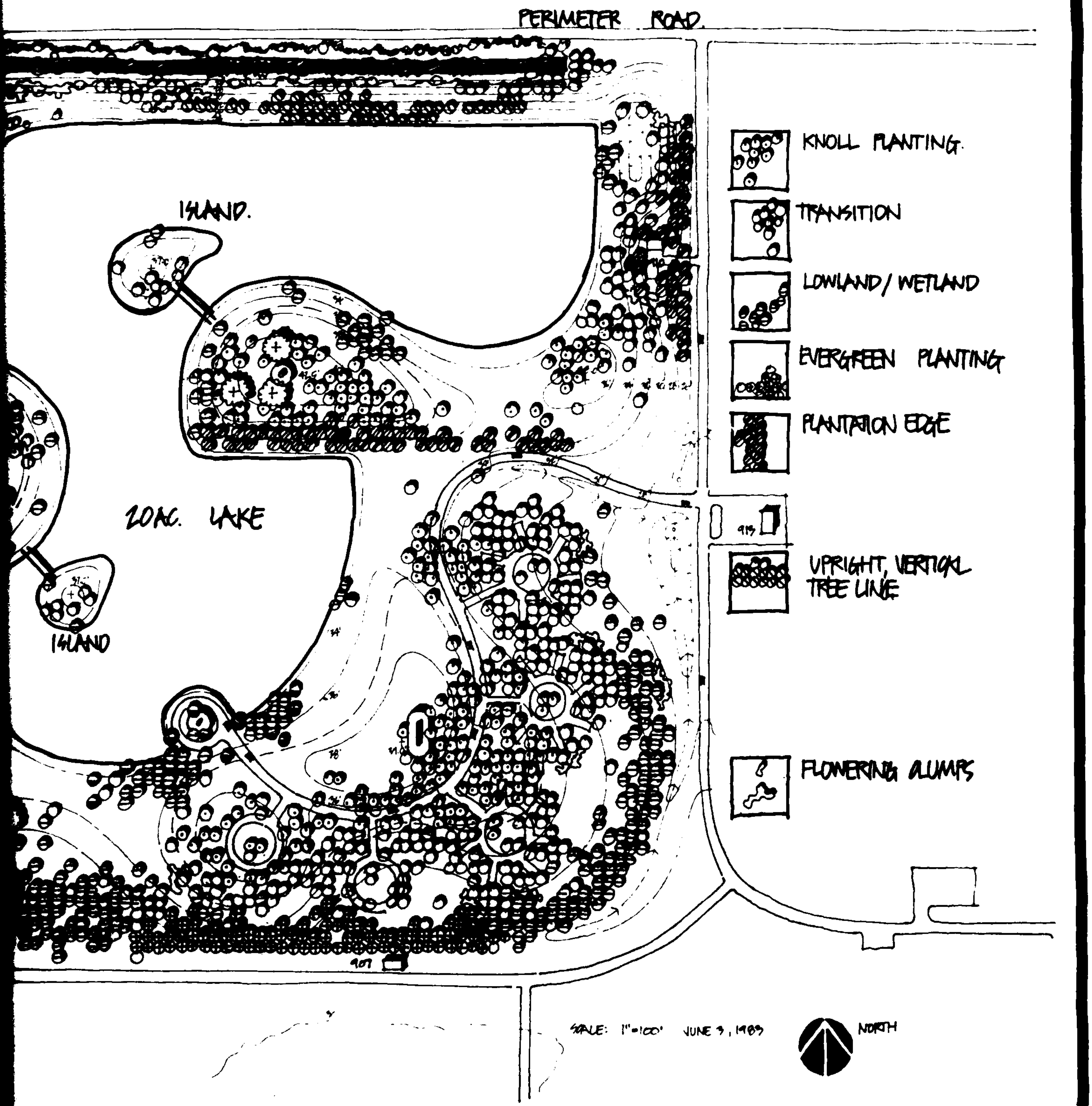



Figure 22. Planting types.


PERIMETER ROAD.
ISLAND.
20AC. LAKE
ISLAND
KNOLL PLANTING.
TRANSITION
LOWLAND/WETLAND
EVERGREEN PLANTING
PLANTATION EDGE
UPRIGHT, VERTICAL TREE LINE
FLOWERING CLUMPS
SCALE: 1"=100' JUNE 3, 1983
NORTH

2

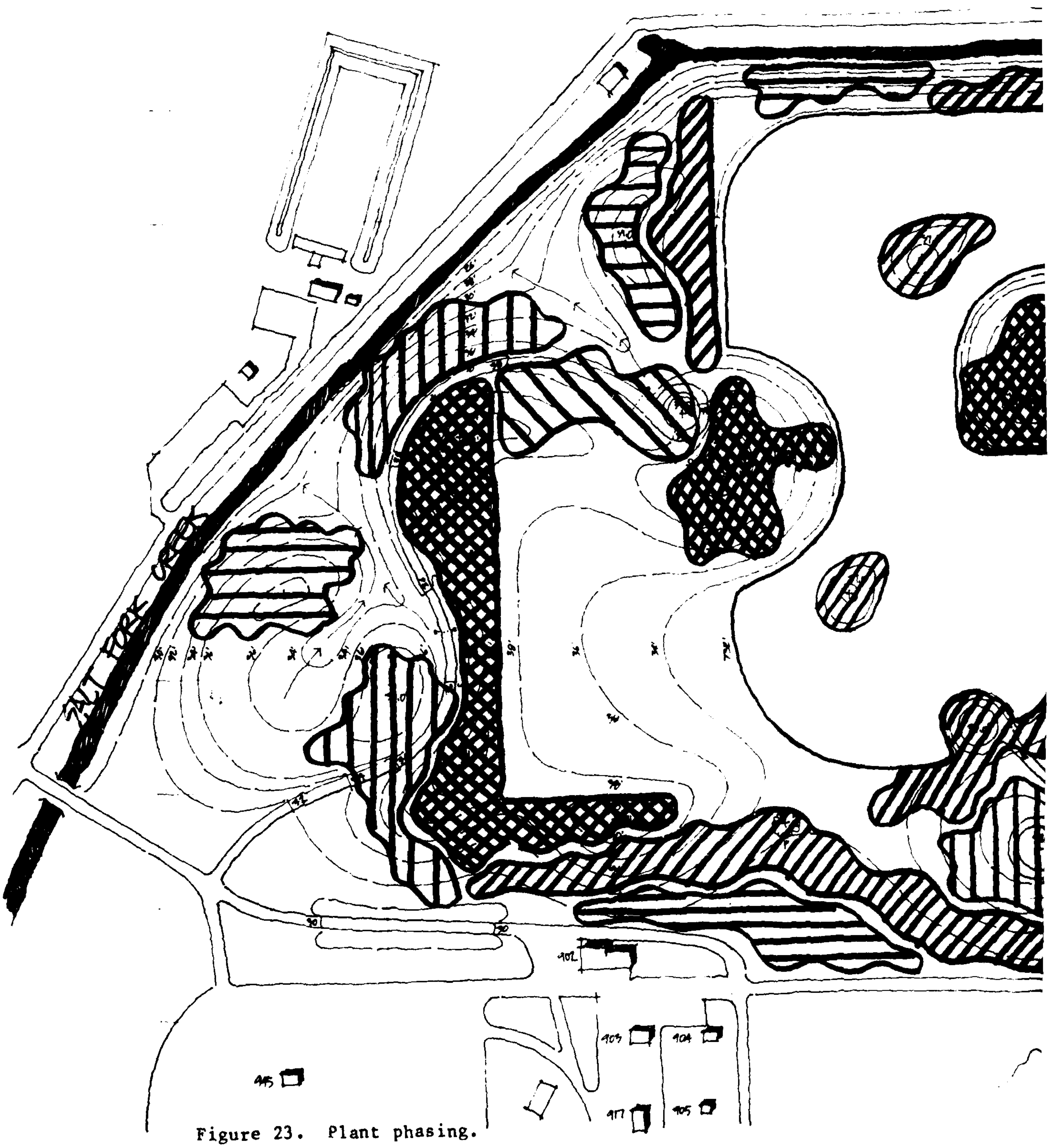
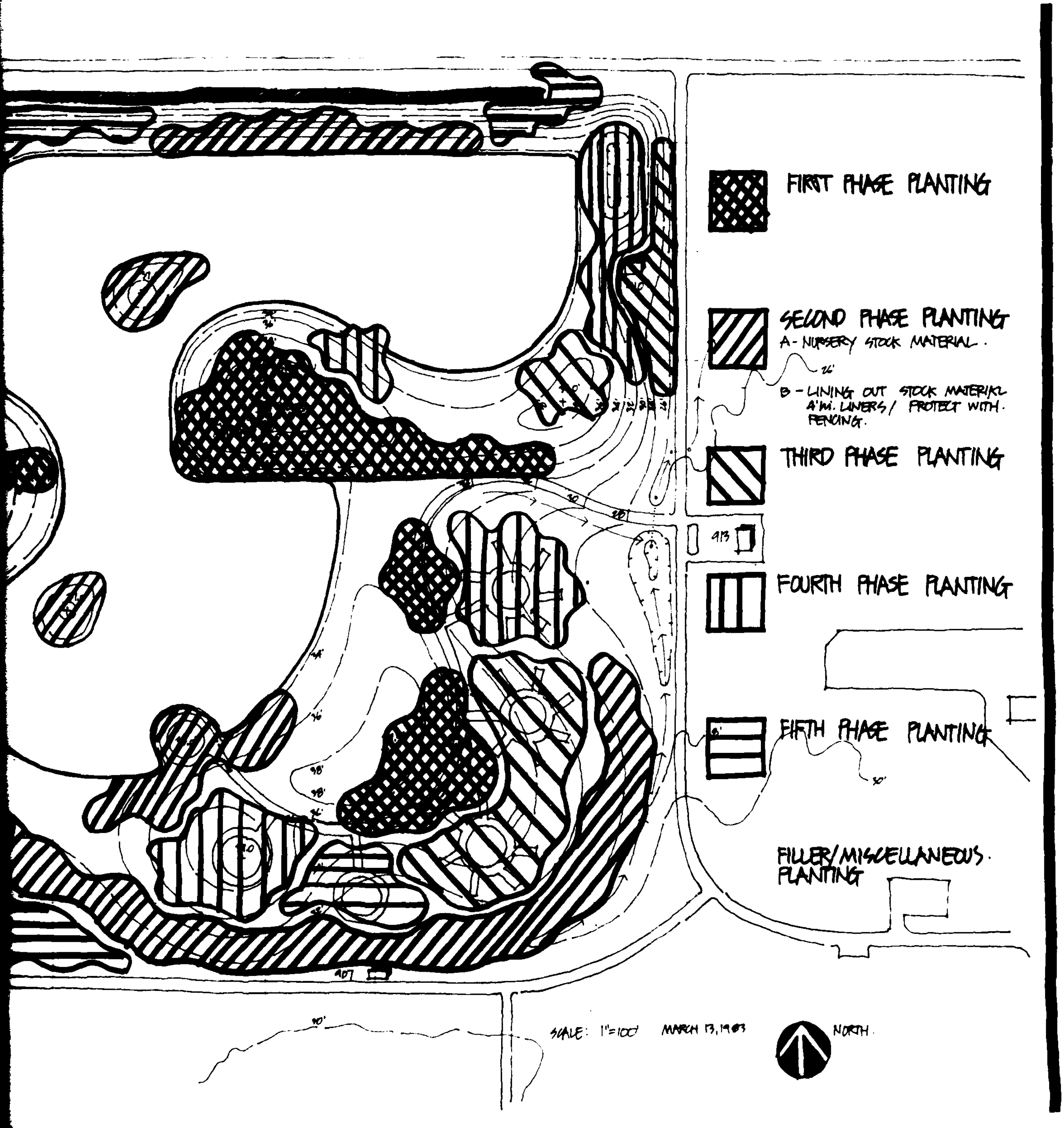



Figure 23. Plant phasing.


FIRST PHASE PLANTING
SECOND PHASE PLANTING
A - NURSERY STOCK MATERIAL.
B - LINING OUT STOCK MATERIAL
A'WI. LINERS / PROTECT WITH FENCING.
THIRD PHASE PLANTING
FOURTH PHASE PLANTING
FIFTH PHASE PLANTING
FILLER/MISCELLANEOUS PLANTING
SCALE: 1"=100' MARCH 13, 1983
NORTH

2

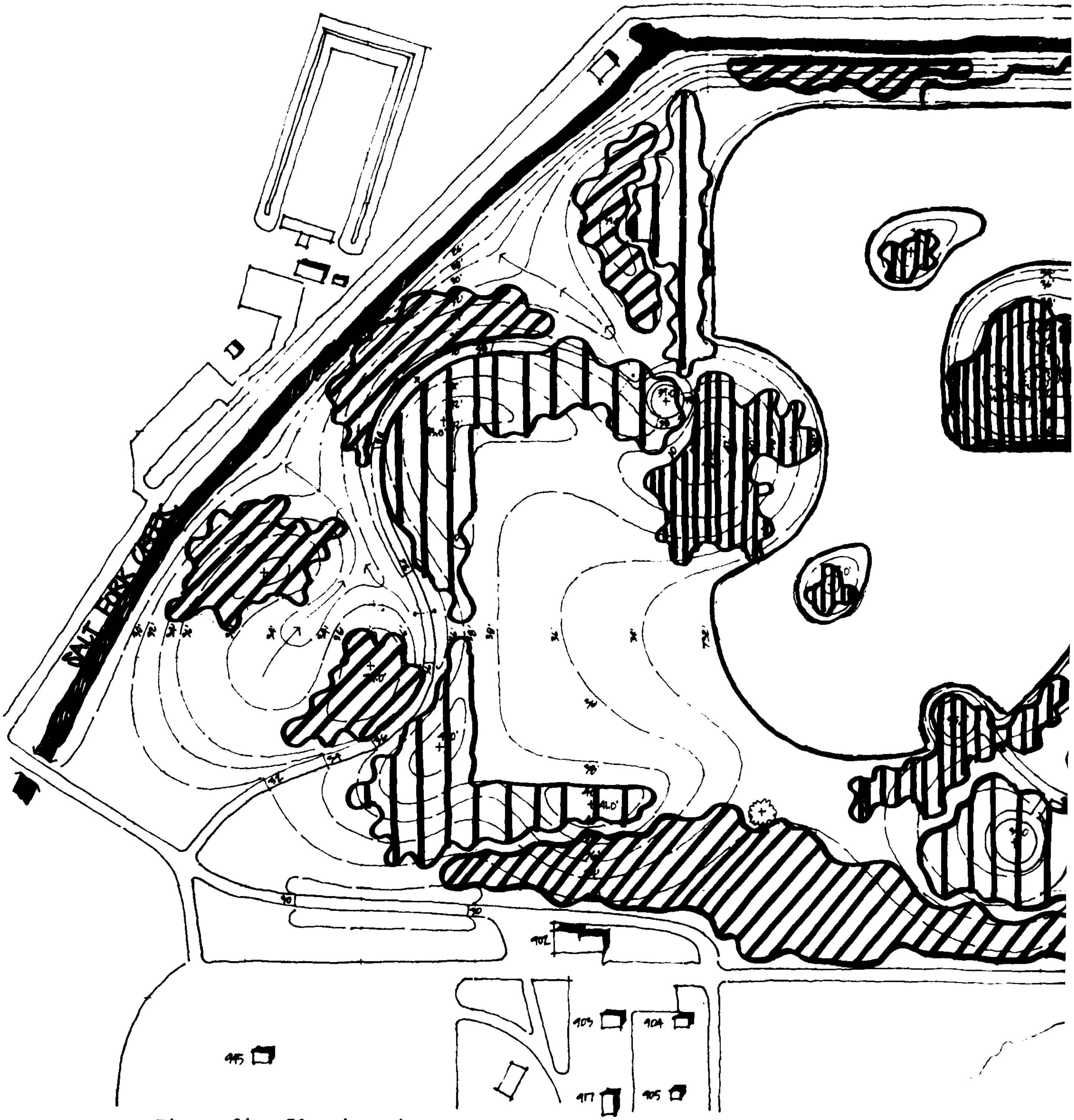
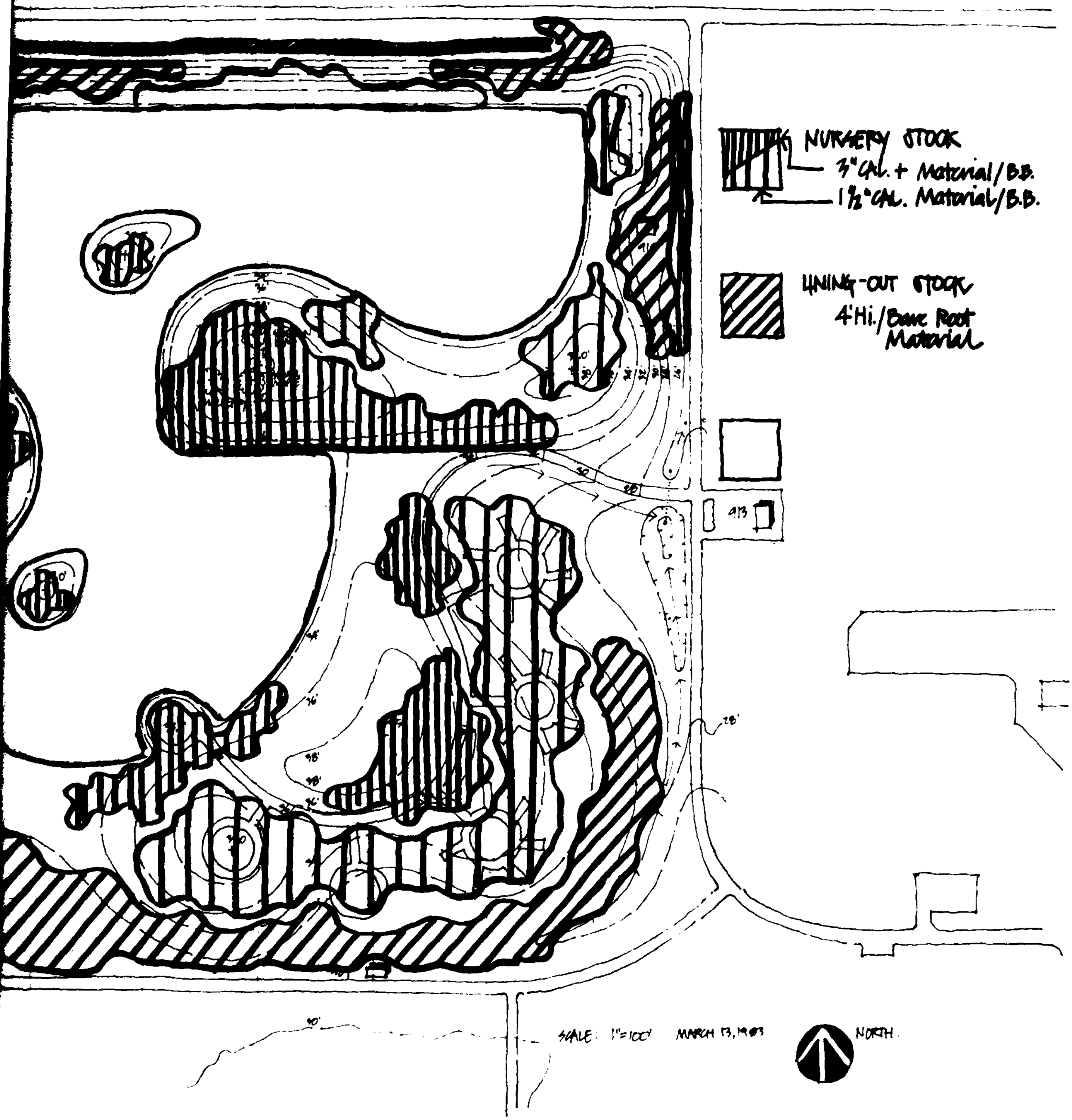


Figure 24. Planting size strategy.


NURSERY STOCK
3" CAL. + Material/B.B.
1½" CAL. Material/B.B.
LINING-OUT STOCK
4'Hi./Bare Root Material
SCALE: 1"=100'
MARCH 13, 1983
NORTH

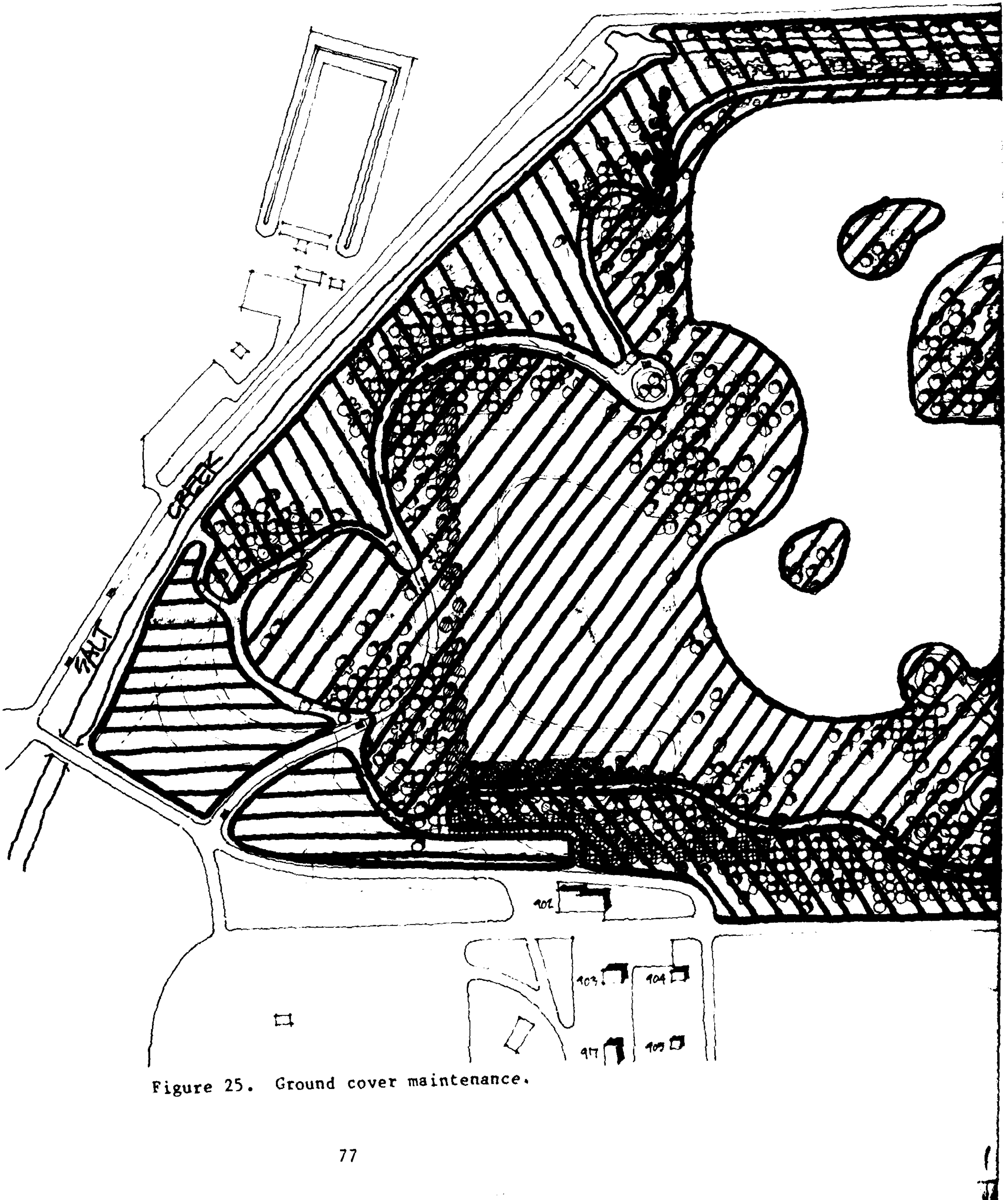
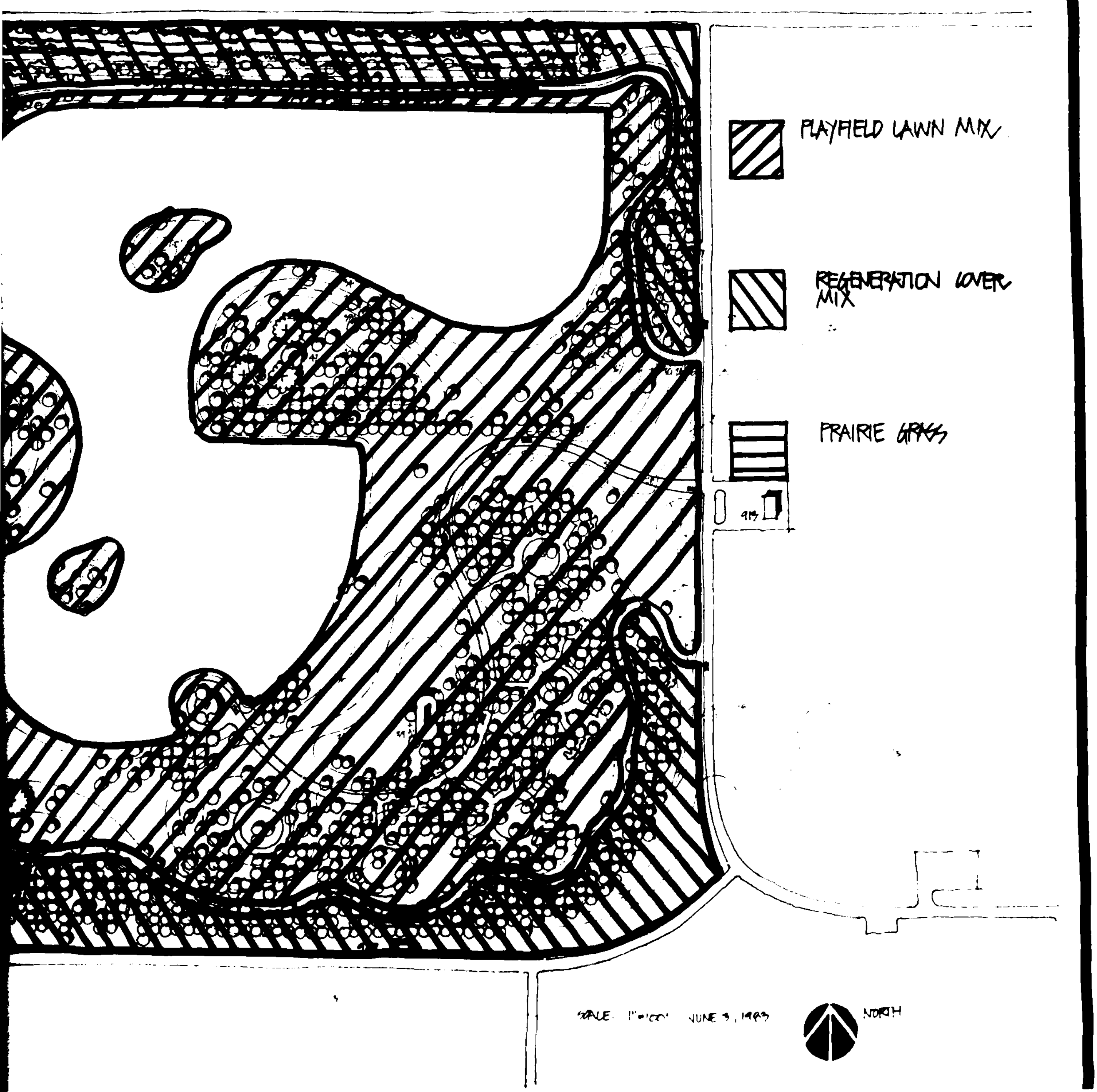



Figure 25. Ground cover maintenance.



PLAYFIELD LAWN MIX
REGENERATION COVER MIX
PRAIRIE GRASS
SCALE
JUNE 3, 1993
NORTH

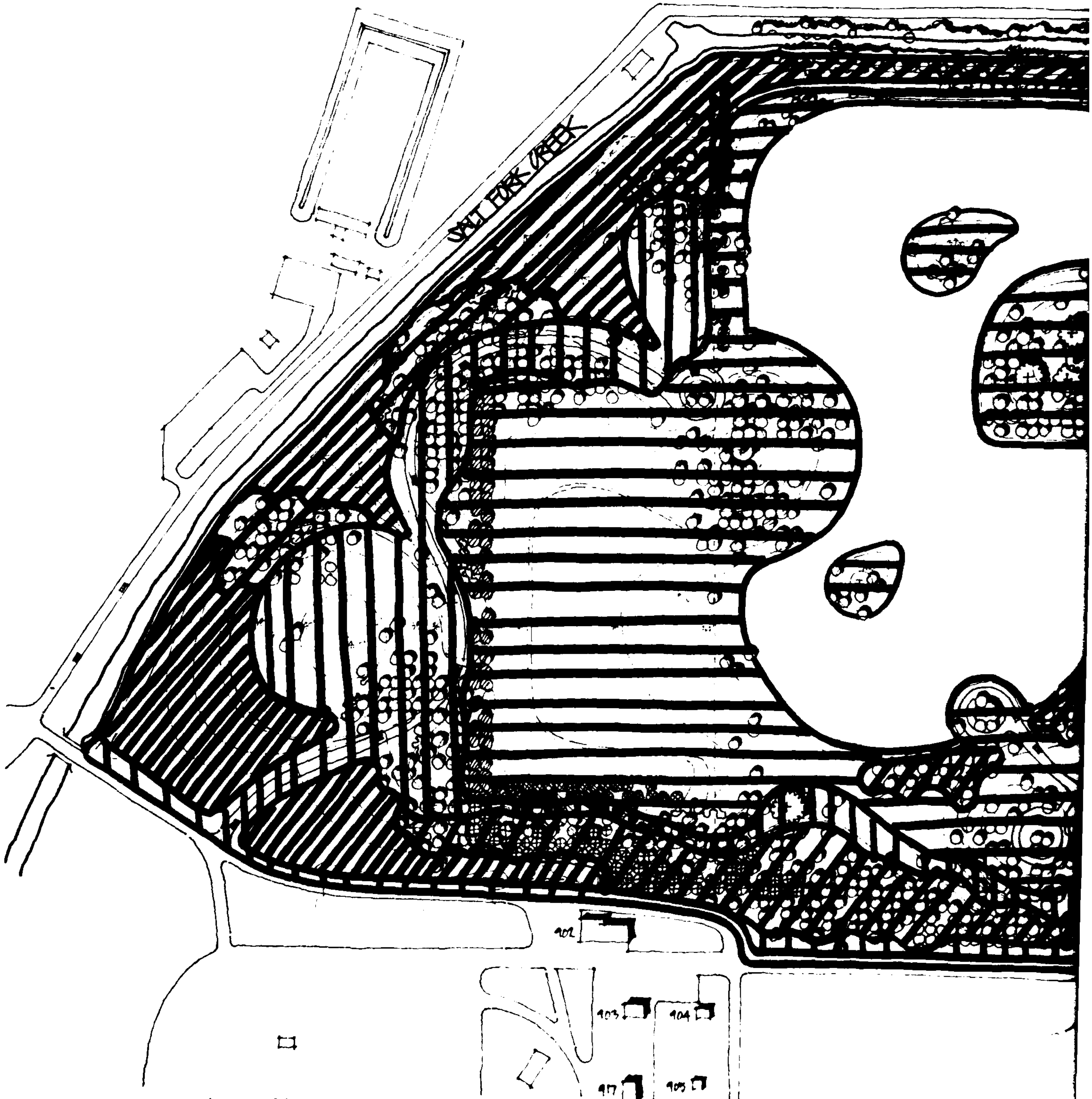
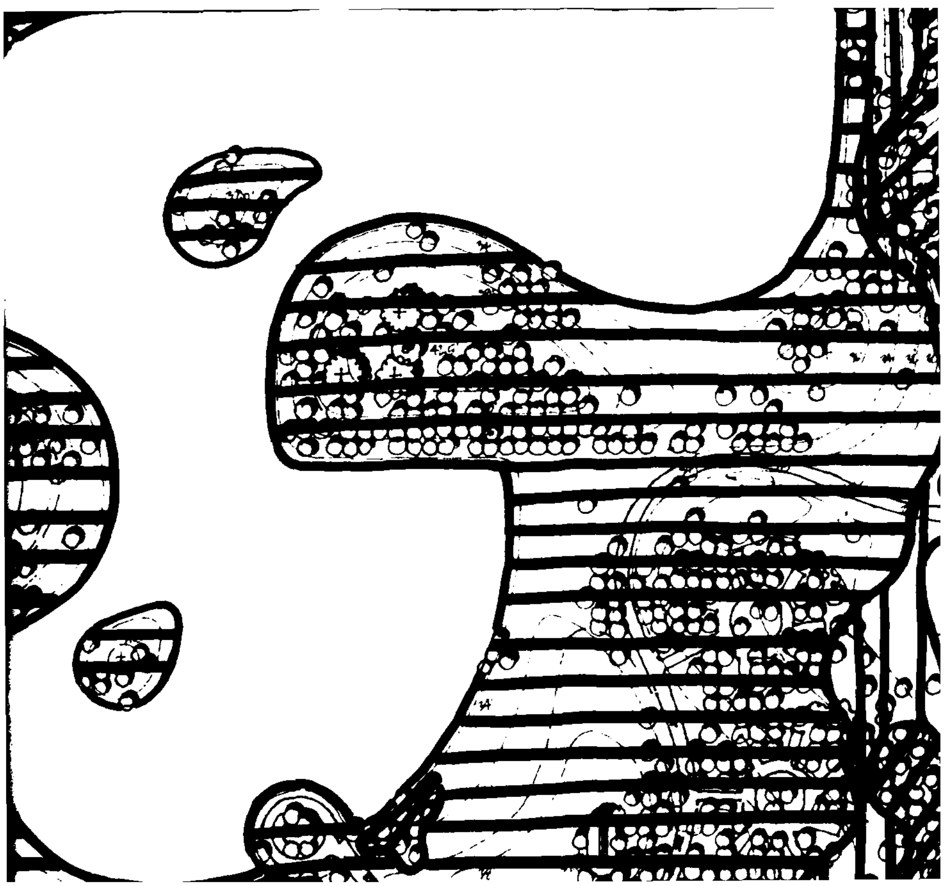



Figure 26. Maintenance classes.



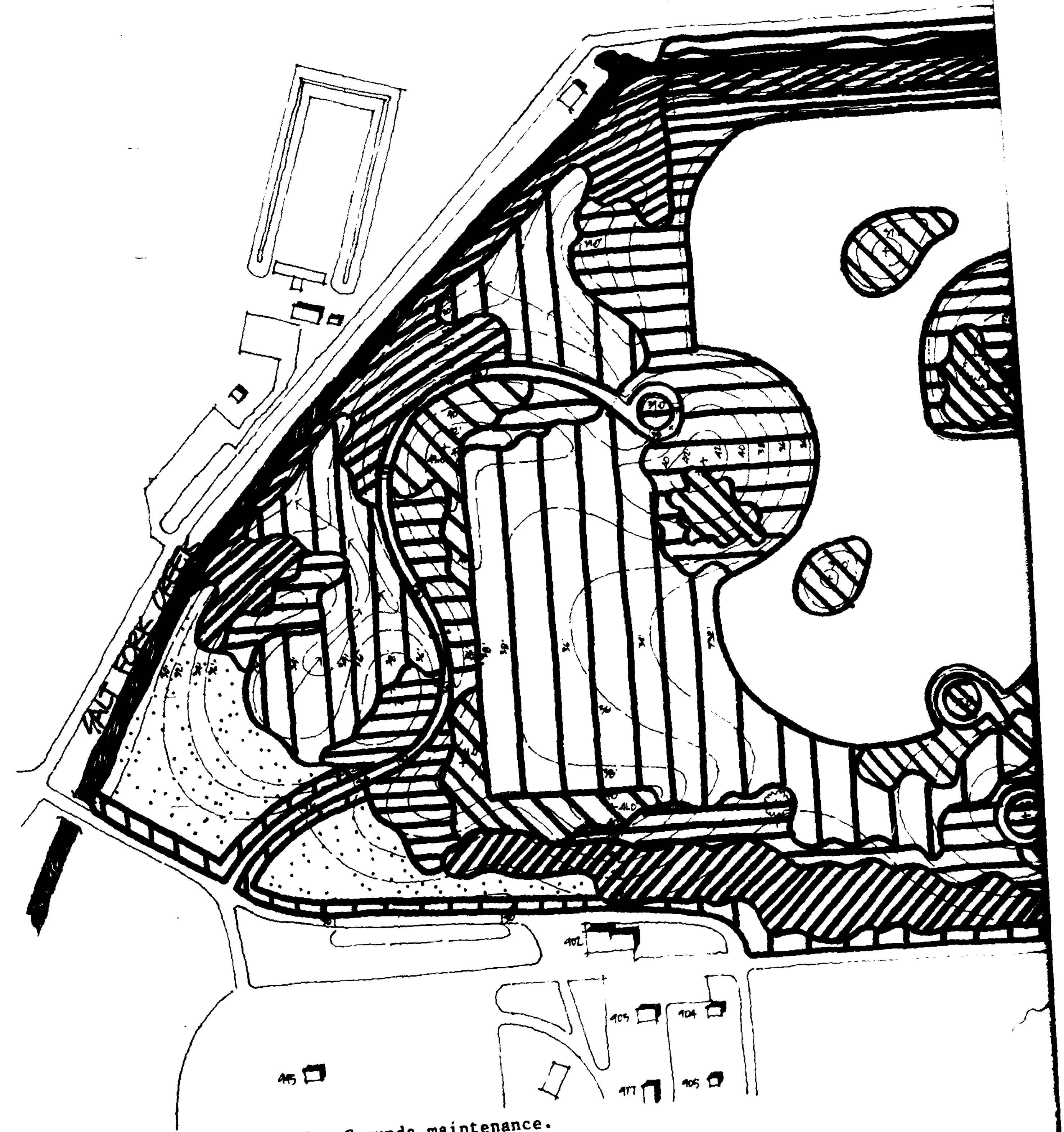
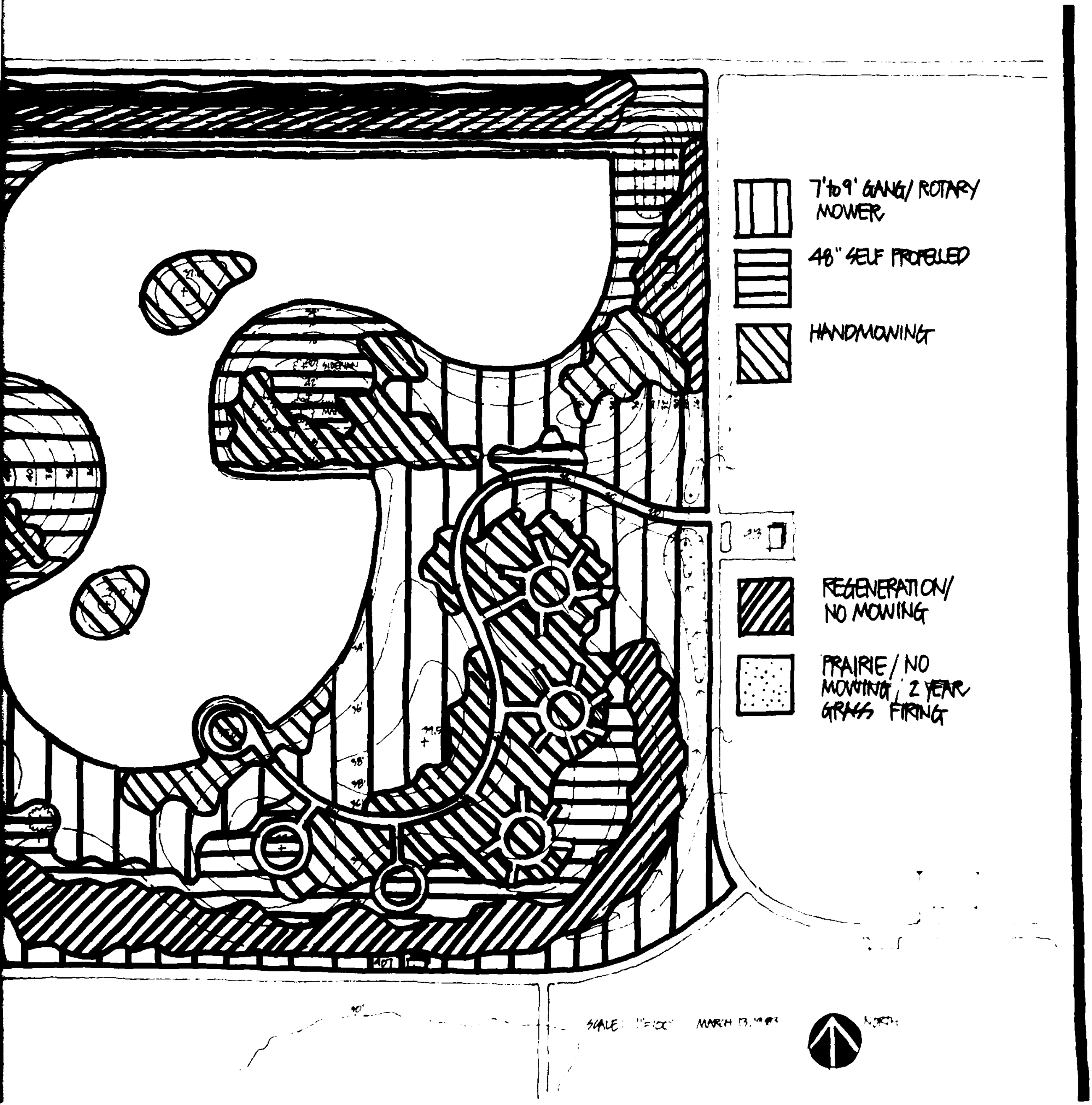



Figure 27. Grounds maintenance.



7' to 9' GANG/ ROTARY MOWER
48" SELF PROPELLED
HANDMOWING
REGENERATION/ NO MOWING
PRAIRIE/ NO MOWING, 2 YEAR GRASS FIRING
SCALE
MARCH 13


2

## Table 8

## Recreation Area Plant List

Criteria:
- shallow or fibrous roots
- drought tolerant
- exposed situation/summer-winter
- available
- alkaline soils
- tight soils

Knoll Situation:

| | |
|---|---|
| Celtis occidentalis | Prairie Pride Hackberry |
| Fraxinus P. L. Marshall's | Marshall's Seedless Ash |
| Fraxinus A. Rosehill's | Rosehill Ash |
| Fraxinus A. Autumn Applause | Autumn Applause Ash |
| Quercus coccinea | Scarlet Oak |
| Quercus macrocarpa | Burr Oak |
| Tilia euchlora | Crimean Linden |
| Tilia C. Greenspire | Greenspire Linden |
| Tilia tomentosa | Silver Linden |

Transition Situation:

| | |
|---|---|
| Acer campestre | Hedge Maple |
| Acer nigra | Black Maple |
| Acer rubrum "Red Sunset" | Red Sunset Maple |
| Acer R. "Selsinger" | Selsinger Red Maple |
| Acer sacharum "Green Mt." | Green Mt. Sugar Maple |
| Gleditisa T. I. Imperial | Imperial Honey Locust |
| Platanus acerifolia Bloodgood | London Planetree |
| Ulmus parvifolia | True Chinese Elm |
| (Populus alba) | White Poplar |

Swale/Wet Situation:

| | |
|---|---|
| Acer saccharinum | Silver Maple |
| Betula nigra | River Birch |
| Quercus bicolor | Swamp White Oak |
| Liriodendron tulipifera | Tulip Tree |

Water Edge:

| | |
|---|---|
| Salix B. Niobe | Golden Willow |
| Taxodium distichum | Bald Cypress |

Table 8 (cont'd)

| | |
|---|---|
| **Flowering Clumps:** | |
| Corataegus crus-galli | Cockspur Thorn |
| Corataegus mollis | Downy Hawthorn |
| Corataegus punctata | Dotted Hawthorn |
| Malus floribunda | Japanese Flowering Crab |
| Malus zumi calocarpa | Zumi Crabapple |
| Acer ginnkla | Amur Maple |
| Acer griseum | Paperback Maple |
| **Dike Edge:** | |
| Populus a. Bolleana | Bolleana Poplar |
| Acer rubrum Armstrong | Armstrong Red Maple |
| (Populus deltoides) | |
| **Evergreens:** | |
| Juniperus chin. columnaris | Blue Columnar Chin. Juniper |
| Thwa occidentals techny or (Nigra) | Techny Arborvitae |
| Pinus strobus | White Pine |

# 7 LAKE MANAGEMENT

Fishing lakes require a well planned initial stocking of fish plus ongoing management. It is essential to understand that every lake is unique and must be treated as such; nevertheless, two basic considerations are common to all lakes: fishery management and lake maintenance.

## Fishery Management

### *Stocking Recommendations*

A tentative stocking program for the lake was developed in conjunction with Gary Lutterbie of the Illinois Department of Conservation (DOC). Assuming the lake will be filled sometime in late 1983 or early 1984, it would be best to give food organisms at least a 6-month head start and begin stocking in fall of 1984. The Illinois DOC recommends stocking:

1. Approximately 100 largemouth bass fingerlings (2- to 3-in.) per acre.

2. Approximately 500 bluegill sunfish fingerlings (1- to 2-in.) per acre.

3. Approximately 500 redear sunfish fingerlings (1- to 2-in.) per acre.

This initial stocking is standard for most ponds and small lakes, but there is flexibility. If desired, it may be possible to stock hybrid sunfish (bluegill x green) with a reduced capacity for reproduction. This would reduce the chances of bluegill overpopulating the lake and having stunted growth, but would also increase the cost of initial stocking and require frequent restocking. The Illinois DOC does not recommend using hybrid sunfish in lakes of this size, since it requires the addition of 150 breeders per acre as initial stock and 75 to 100 breeders per acre every other year. At an estimated average of $.35/breeder, this amounts to $1050 for the initial stock and $525 to 700 for alternate years. These fish are unavailable from the DOC and must be obtained commercially. In addition, hybrid sunfish typically support a less desirable bass population than do bluegill.[7]

Before stocking bass and sunfish, it would be possible to have a put-and-take rainbow trout fishery for spring 1984. This would probably require stocking in March and would allow fishing until water temperatures increase enough to kill the remaining trout, probably in June. This could be a good opportunity to increase interest in the lake among base personnel.

In the summer of 1985, approximately 100 juvenile (8- to 10-in.) channel catfish could be stocked per acre. These fish would be catchable immediately and should grow rapidly. In addition, another put-and-take trout stocking could be planned for that spring.

Finally, in 1986 or after, 40 to 50 breeder black crappie could be stocked to provide additional panfishing. Crappies grow to much larger sizes

[7] Gary Lutterbie, personal communication.

than bluegill and provide a more varied catch. It is important that the large-mouth bass population be well established before stocking crappie, however, to avoid crappie overpopulation. Figure 28 summarizes the management schedule.

The initial stocking of the bluegill-bass combination (if chosen) will probably cost $50 or less. Channel catfish stocking costs approximately $200 and must be repeated every other year.

*Habitat Enhancement*

Man-made lakes often are deficient in habitat "structure" due to their uniformity. The "edge effect" of shoreline development is one aspect of lake morphology that helps develop habitat diversity; another is the depth distribution and variability of the lake. Diversity can be further increased by adding artificial structures that break up the homogeneity of open water. These structures provide area for growth of attached algae and associated invertebrates as well as shelter for forage fish. The Illinois DOC recommends using scrap auto tires wired together to form a variety of structures with high porosity (see Appendix A). These "tire trees" or fish attractors can be made even more useful by attaching branches or Christmas trees to the tires. Attractors generally are placed in about 10 ft of water, at least 2 ft below the lake's surface. They can be flagged so fishermen know where they are, and should be placed within casting distance from the banks, islands, or piers.

Another way to diversify the habitat is to place piles of brush in selected areas along the shoreline to provide cover for young bass and bluegill. Careful planning is necessary, though, since too much of this cover can overprotect young panfish and cause stunting. The fish attractors can be staked to the lake bottom before filling or placed on the frozen lake after construction and weighted so they sink to the bottom during ice breakup.

*Fisherman Access*

Since no boats will be allowed on the lake, it is important to provide access to all parts of the lake for the fishermen. In addition to the islands, several piers will be constructed for casting to all areas. The piers will also act as panfish attractors. All banks except the north one (bordering the creek) will be pleasant fishing areas, so that fishing efforts are spaced as evenly as possible around the lake.

*Fishing Regulations*

The importance of establishing and enforcing regulations cannot be overemphasized. An imbalance in the fish community created when fishermen keep too many bass and not enough panfish is difficult to correct. For this reason, a 14- to 15-in. minimum should be required for keeping bass. The state limit for bass is 6 per day, and if possible, this maximum should be lowered further at Chanute. Catfish catches also should be limited to 5 or 6 per fisherman per day. Fishing may be allowed immediately after stocking, but these rules must be enforced.

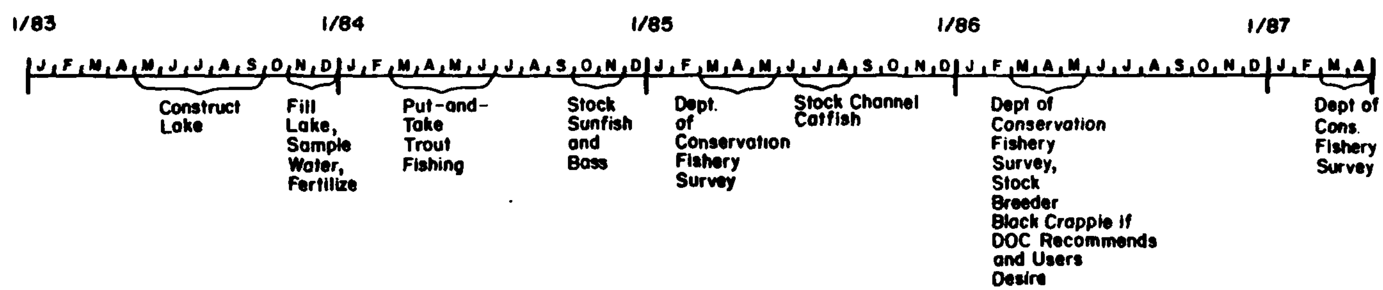



Figure 28. Proposed fishery management schedule.

Additional regulations prevent rough species entry into the lake. For this reason, bait minnows should be prohibited since they are often of mixed varieties and may contain carp or other undesirable species. When used as bait, they inevitably escape and reproduce in the lake. Also, signs should be posted advising persons with fish from other waters, especially from the adjacent Salt Fork Creek, not to release them into the lake.

It is customary for Department of Defense installations to comply with State laws regarding fish and wildlife management. Therefore, fishermen at the Chanute recreational lake must have a fishing license from the State of Illinois. The annual license fee is $7.50. All military personnel will be treated the same as Illinois residents regardless of their point of entry into the service. Military personnel who are Illinois residents and are on annual leave are not required to have an Illinois fishing license.

*Fisherman Education*

The best way to maintain quality fishing is to gain the users' cooperation. A brochure explaining problems with starting a fishing lake has been published by the Illinois DOC in an effort to educate fishermen (included as Appendix B). Similar literature should be available at the Chanute recreation lake so users know what to expect and how they can help maintain a high-quality fishery.

*Fish Population Management*

The two most important tasks in maintaining a desirable fish community are fish sampling and manipulation of the species' relative abundance. The most efficient sampling method is electroshock from a boat. This requires trained personnel using specially designed equipment to stun and capture fish. The Illinois DOC will do annual or bi-annual surveys to assess fishery quality if requested.[8]

Surveys indicate whether the community of forage (panfish) and predator (bass) species is balanced. If not, corrective actions are necessary. Depending on how badly the community is imbalanced, there are a number of options for population manipulation.

A change in regulations to reduce fishing pressure on the depressed population (usually bass) might be sufficient to restore balance. If this is not deemed adequate by fisheries personnel, then a drawdown of the lake by several feet might help flush overabundant panfish out of protected, shallow areas so the bass can feed on them more easily.

An alternative is partial poisoning of the lake in an attempt to kill a large number of panfish without killing many of the bass. If this is unsuccessful, the best option is to remove the entire fish community by poisoning and then restock the lake.

If regulations are followed and fishing pressure falls within some reasonable range, the initial bluegill-bass stocking should stay balanced for up to 10 years. Catfish will need to be restocked every other year since they

[8] Gary Lutterbie, personal communication.

usually do not reproduce successfully in small lakes. If hybrid sunfish are chosen over bluegill-redear, they also will require frequent restocking.

## Lake Maintenance

In addition to managing the fishery, the recreation lake will have a number of related maintenance tasks. Most of these are groundskeeping, such as mowing, trail maintenance, and tree pruning (these are included in the planting and construction sections of the report). Another important task at the lake is control of algae, rooted plants, and burrowing animals.

### *Algae and Rooted Plant Control*

Algae and rooted plants often overrun Illinois lakes, usually due to high nutrient levels and extensive shallow areas. Since nutrients usually enter via the watershed, they should not cause problems at Chanute's lake. Also, rooted plants will have only small fringes on the lake edge where depths will be less than 3 ft, which will limit their growth. Small beds that do grow along the edge can be controlled by hand pulling. Should nutrient levels become high enough to support planktonic or filamentous algae blooms, herbicides such as copper sulfate and aquazine can be applied. A variety of safe herbicides are also available for rooted plants, and the Illinois DOC will provide personnel to apply them if it becomes necessary. For a summary of plant control recommendations, see Fishery Bulletin No. 4.[9]

### *Burrowing Animal Control*

Burrowing animals, especially muskrats, can endanger earthen water-retaining structures. However, few fishing lakes have experienced muskrat problems in Illinois. A trapping program at the Chanute site has eliminated a number of muskrats each year. This program should be continued for monitoring the area, but once the lagoons are dredged and deepened there will be little prime muskrat habitat available. Most of the shallow areas will be gone, with essentially no rooted plants -- a situation in stark contrast to the existing area, which has plenty of shallow water and rooted plants for food. If problems do occur, the DOC recommends:[10]

1. Remove all rooted vegetation in shallow areas (cattails, etc.).

2. Riprap shorelines from 2 ft above the water line to 3 ft below.

3. Keep the banks mowed.

4. Allow trapping.

5. Drill holes at 3- or 4-ft intervals along affected shorelines, about 2 ft below the water line. Place 4 to 5 oz of creosote, calcium carbide, or

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[9] Illinois Department of Conservation, Aquatic Weeds, Their Identification and Methods of Control, Fishery Bulletin No. 4 (Division of Fish and Wildlife Resources, 1981).

[10] Illinois Department of Conservation, Small Lakes and Ponds, Their Construction and Care, Fishery Bulletin No. 3 (Division of Fisheries, 1980).

napthalene in each hole and seal with dirt. When a digging muskrat comes in contact with the treated zone, he usually leaves the area. Note that the banks of the lake will already be mowed and riprapped, so the need for the additional measures is unlikely.

## 8 CONCLUSIONS

Construction of the proposed recreational facility is feasible for the site investigated at Chanute Air Force Base, Illinois. Based on soil and water analyses by Daily and Associates Engineers, the area can support a 20-acre lake without substantial seepage and without contamination from adjacent landfills. The landfills will remain undisturbed. The facility is designed to incorporate two abandoned lagoons into the lake, thus reducing excavation requirements. The lake can support a quality sport fishery with proper management.

Landscaping plans are critical to providing a pleasant recreational environment at the site. Trees and grass will be planted over a period of 10 years following a design intended to maximize both present and future recreational opportunities. The plantings are innovative, requiring low maintenance. A planting schedule will provide direction for base personnel as well as volunteer groups and visiting military companies working on the facility.

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U.S. Soil Conservation Service, Warm-Water Fishponds, Farmers Bulletin No. 2250 (U.S. Department of Agriculture, 1971).

APPENDIX A:

FISH ATTRACTORS

by

G. Lutterbie, District Fisheries Biologist, Illinois Department of Conservation

Enclosed are examples of two types of commonly used fish attractors made from tires (Figures A1 and A2). As you can imagine, a wide variety of shapes and sizes could be used with equal success.

Just drill holes in the tires where you would connect them with a good stiff wire. The wire should be strong enough to support the weight of all the tires and thick enough so as not to rust through easily. You may want to temporarily build the attractor at your house to drill the holes, then number the tires, dismantle and move them to the lake.

You should also drill large holes in the tires where air pockets might form to prevent the attractor from floating or sinking unevenly.

Construct the fish attractor on ice where you want it to settle the next spring. Sometimes people tie the attractor to the shore to prevent it from shifting if the ice should start to move. To have more weight others have poured cement in the bottom row of tires. These are just suggestions about what other people have done, some of which may help.

A good idea in addition to just using the tires is to stick limbs and branches or Christmas trees into the tire openings to make a brush and tire fish attractor. The brush should also be wired to the tires.

The attractor should be placed in water so that the top is about 2 ft under water.

In addition it may be a good idea to place piles of brush along the shoreline. These piles could be staked into place to prevent them from moving. Christmas trees would work well here. The brush piles should be about 20 ft long and extend out about 4 to 6 ft from shore. This would provide good cover for young bass and bluegill.

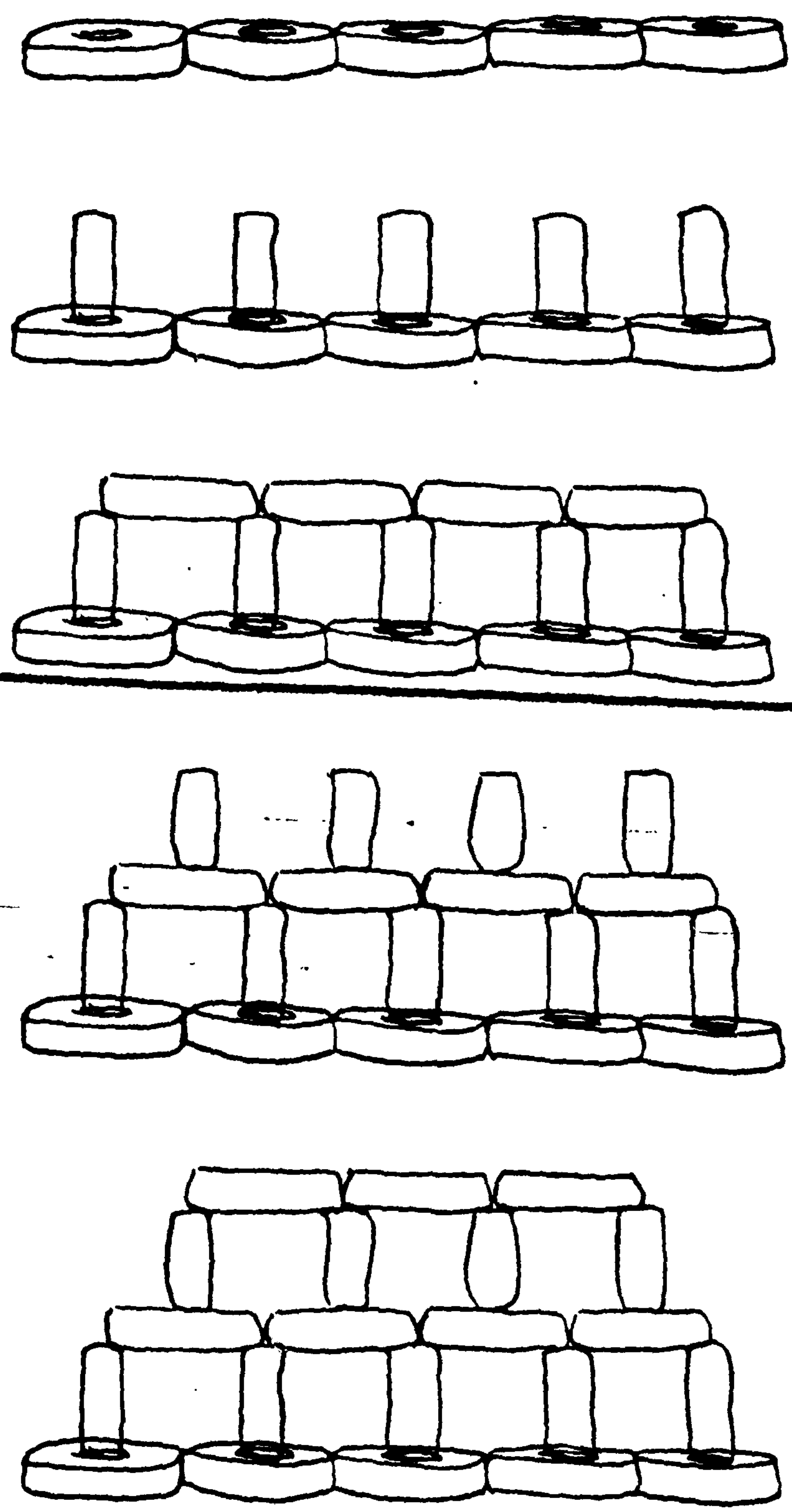

Figure A1. Schematic for constructing one type of used-tire fish attractor.

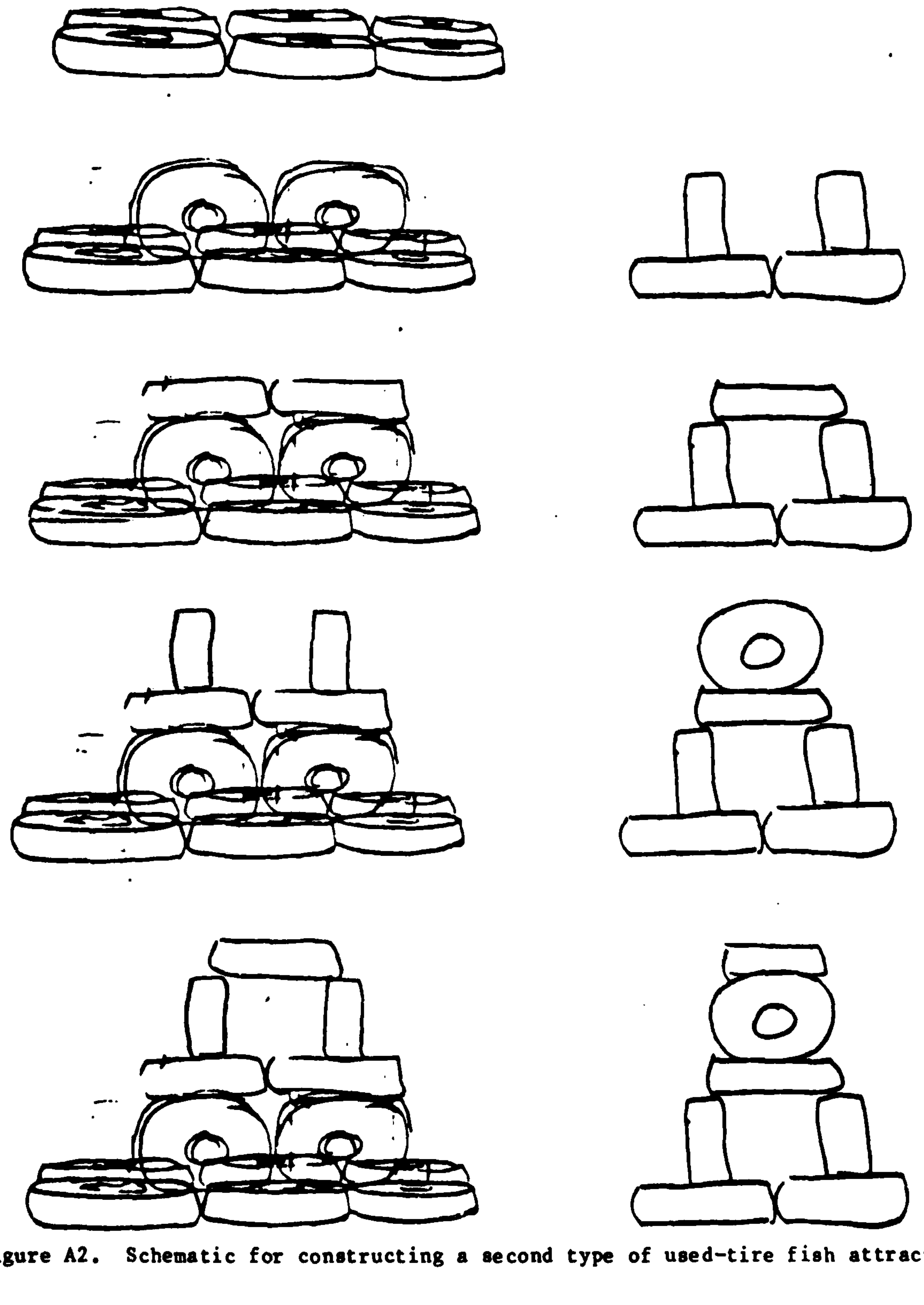

Figure A2. Schematic for constructing a second type of used-tire fish attractor.

APPENDIX B:

# FISHERIES MANAGEMENT GUIDELINES

by

Leo Rock, Regional Fisheries Biologist, Illinois Department of Conservation
(originally published as a pamphlet entitled "Instant Fishing? No Way!")

In the early years of fish conservation, people attempting to improve fishing followed a simple recipe: Take a little water, add fish and a few regulations and, bingo, instant fishing! If somehow the results were a little botched, the recipe called for the addition of a few more milk cans of fish or a couple more regulations.

This naive little formula dominated fish conservation for decades. Then, a few people started to question it. The cornerstone of modern fish conservation (now called fish management) was laid with the new concept of carrying capacity and its application to the aquatic environment.

Carrying capacity simply means the ability of an area of land to support certain populations of animals at a given time. It depends largely on food and cover and it varies with the season. Farmers and gardeners have been applying the concept for years. The farmer knows an acre of pasture can support only so many pounds of beef cattle. Gardeners understand the same principle and manage their carrots by systematically thinning them out to permit rapid growth of those remaining.

It is a paradox to American inventive technology and understanding that it took so long for people to perceive aquatic systems as pastures -- pastures that support extremely prolific "livestock" (fish and other aquatic animals and plants) whose rate of growth depends on the amount of food and living space available. It was discovered, for instance, that a small fish was not necessarily a young fish -- it might be an underfed old timer!

Fishery research accelerated rapidly in the 1940s and early 1950s despite many complexities such as the realization that no two waters were alike -- be they ponds, lakes, streams, or even manmade ponds in a typical fish hatchery. An enormous warehouse of information was gathered on the extraordinarily complex life systems hidden in the watery world.

During this period of accelerated research, professional trouble-shooters appeared on the scene. They were conscientious people who wanted to find answers, and in time they did. Unfortunately, though, the answers often were embarrassing to the old-line fish conservationists.

One answer in particular ruffled the feathers of the proponents of the fish stocking/protection-by-regulation recipe. That answer demonstrated the principle of inversity, the tendency of wildlife to reproduce poorly under crowded conditions. This principle meant you couldn't necessarily improve a fishery by adding more fish or by restricting catches. Often these practices actually were harmful since they increased the population past the carrying capacity of its environment. The crowded conditions meant the fish grew and reproduced poorly. The result? Lousy fishing.

The fishery biologists continued to discover more and more defects in the fish conservation cookbook recipe. Sometimes they were openly ridiculed for their criticism of past fish conservation methods, but they were an enthusiastic bunch and stuck to their knitting. At about the same time, the public was beginning to rely more on specialists such as doctors, lawyers, engineers, and agronomists; eventually, more and more credence was given to the work of the trained fishery expert, who was a new kind of specialist. Fish management emerged as a science and captured the interest of perceptive fishers, aspiring wildlife students, and government and philanthropic organizations who could offer financial support.

What is fish management? It is manipulating fish populations in ways that will provide optimal numbers of catchable-size fish. Fish management is a science because it acknowledges and uses scientific method — the approach that gathers general truths and laws obtained by accepted methods of experimentation.

How can fish management scientists manipulate fish populations? Management may involve playing predatory game species against their prey (the panfishes). It may mean controlling less desirable species, or it can mean controlling overpopulaton. Sometimes entire fish populations must be eradicated and the body of water restocked with more desirable species in carefully controlled proportions. Stocking and regulating still are valid and important fish management tools, but they are used with much more discrimination than in the past and in combination with other tools.

All of these management techniques require knowledge of the species present, their relative abundance, their age classes, their rates of growth and their life histories. Knowledge of a particular species' habitat needs is necessary before that species can be managed.

Angler preferences also must be considered. Often a fish which is a "weed" species in one region is a highly prized fish by anglers elsewhere. And there's the question of the relative vulnerability of a species. Smallmouth bass, for example, are more catchable than largemouth bass; and bluegill are more vulnerable to being caught than redear sunfish.

No matter which tools are being used or what special considerations are being made, the goal of fish management is to preserve, protect, and ensure intelligent use of aquatic resources.

Although fish management has come a long way in the past 30 years, it still is a relatively young science. There is much to be learned. The vastness of the unexplored factors that direct aquatic systems are humbling indeed, and there still are basic problems. One of the major jobs of fish management still is to "unsell" the old fish conservation recipe with its overemphasis on stocking, and to overcome the ideas of hardcore individuals who cling to stocking as the panacea to cure all ailments in a fishery.

Another problem concerns conservation education in the schools. Many conservation and ecology courses offered at the elementary and high school levels are outdated. For instance, the term "balance" is sometimes misused. "Balance" usually describes natural fluctuations of animal populations around a constant level which tend to maintain a steady state. However, there are

almost no waters left which have not been disrupted by factors introduced by man. Human interference is so pronounced that we no longer can expect to find a system of natural checks and balances at work in an aquatic ecosystem. Selected species, numbers, and sizes of fishes released into an artificial habitat represent artificial ecosystems. In any such ecosystem we could not expect a good fishery to be produced for an indefinite period of time. "Balance" in the old sense meant a kind of automatic and ongoing stability that no longer is possible; it now refers to an ecosystem in which the checks and balances are artificially introduced by using the tools of fishery management.

Still another problem is the need for technological advances to keep up with the findings of fundamental research. For instance, there is a need for more efficient fish collecting devices and for improved selective methods to manipulate fish populations without adversely affecting other components of the aquatic community.

Although the science of fish management still is in the fledgling stage with many shortcomings, it is, nevertheless, a dynamic pursuit dedicated to the growth of its own expertise and to improve stewardship of aquatic resources. No biological science is exact. Trial and error still are inherent to biological management at times, but precise results are becoming more predictable with advances in research and technology.

The stocking/regulation recipe is largely a thing of the past. It has been replaced by the science of fish management, an exciting and challenging chapter in the human quest to know the unknown.

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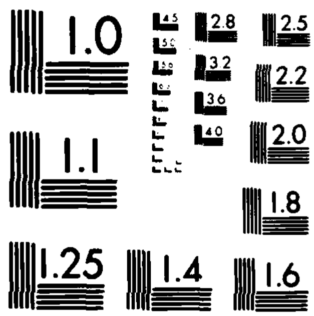


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